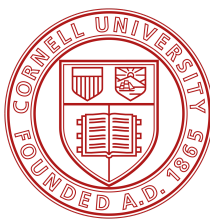




# Green Cities

Equity and  
well-being

Green Cities course  
Cornell University  
2023



# Cornell University

This book features individual essays and group essays written by students in the 3-week “Green Cities” course.

Cornell University Summer College, June 20 – July 7 2023.

Instructor: Dr. **Alex Kudryavtsev**

Teaching Assistants: **Elena Dominguez Contreras, Nish Singh, and Xin (Fish) Yu**

## About

Individual research essays in this book are written by students in Green Cities, a 3-week 3-credit online course offered by Cornell University in summer 2023. The course focused on creating sustainable and equitable cities. Course participants were pre-college students from several countries, as well as current Cornell University undergraduate students.

## Acknowledgements

The students and teaching team would like to thank everyone who supported this course. **Janna Dawn, Ruby Brown**, and other staff at the Cornell University Summer College helped recruit and support students. Several guest lecturers, including **Fish Yu** (Cornell University), **Michael Brodsky** (Loyola Marymount University), **Akiima Price** (Friends of Anacostia Park), and **Claudia Tomateo** (The New School) have enriched students’ learning by sharing their academic and practical expertise. A former student of this course, **Jaeyong Sung** (South Korea), presented his environmental projects. The Environment & Sustainability major at Cornell University has been discussed by **Suzanne Wapner** and **Colleen Kearns**. The teaching team thanks all students in this course for their collaboration, creativity, hard work, and enthusiasm, as well as for their contribution to solving urban socio-ecological problems. The research ideas you generate, the leadership you provide, and the environmental actions you take will help us build more sustainable and equitable cities in the future.

## Disclaimer

All ideas and opinions in this book are students’ own, and may not reflect opinions of the course instructor, teaching assistants, or Cornell University. Students are responsible for correct citations, acknowledgment of others’ work, and proper use of copyrighted materials.

## Suggested reference

Kudryavtsev, A., Dominguez Contreras, E., Singh, K; Xin, Y. (Eds.) (2023). *Green Cities: Equity and well-being. Students’ research essays from the Green Cities course*. Ithaca, New York: Cornell University.

# Table of contents

<b>Finding Equity Within Urban Sprawl Solutions</b> — <i>Aasha Patel</i>	5
<b>Infinite Solar Energy And Finite Uses</b> — <i>Andrew Nam</i>	7
<b>Shenzhen’s Green Renaissance</b> — <i>Bohan Hu</i>	9
<b>Urban Farming: An Oasis In The Food Desert</b> — <i>Brennan Cleary</i>	11
<b>Tackling The Urban Digital Divide</b> — <i>Brian Guo</i>	13
<b>Smart Cities And Citizenship Engagement</b> — <i>Chenhui Mou</i>	15
<b>Air And Waste Pollution In Minority Areas</b> — <i>Christina Mink</i>	17
<b>City Disasters: How To Preserve Equity</b> — <i>Daniel Dixon</i>	19
<b>Green Gentrification</b> — <i>Eugene Kwon</i>	21
<b>Noise Pollution In Dhaka: Turning Down The Volume</b> — <i>Jialin Jiang</i>	23
<b>Soccer Field Innovation</b> — <i>Jinxi Yu</i>	25
<b>More Green, Same Parking</b> — <i>Jongwhan Sung</i>	27
<b>The Problems With Shanghai’s Pocket Park Construction Project</b> — <i>Junwen Xie</i>	29
<b>How Mangroves Can Mitigate Jakarta’s Sinking Problem</b> — <i>Karina Gunawan</i>	31
<b>Enhancing Equity In Green City Planning</b> — <i>Kitty Zhang</i>	33
<b>After School Climate Assemblies</b> — <i>Nivedha Goli</i>	35
<b>A New View Of Death</b> — <i>Sabrina Lewis</i>	37
<b>Usable Waste</b> — <i>Samantha Liu</i>	39
<b>Stewardship To Build Habitat Gardens</b> — <i>Sarah Li</i>	41
<b>From Hotspots To Cool Havens</b> — <i>SeungJun Lee</i>	43
<b>Big Data Cleans Air</b> — <i>Shengjie Li</i>	45
<b>Park Accessibility: Green For Everyone</b> — <i>Sungjoon Park</i>	47
<b>Promoting Extensive Green Roofs In Shanghai</b> — <i>Kaikun Chen</i>	49
<b>Stormwater And Green Infrastructure</b> — <i>Sourish Dutta</i>	51

<b>Creating A Teen-Friendly Green City</b> — <i>Yaqing Yang</i>	53
<b>Approaches To Improve Biophilic Activity, Knowledge, And Attitudes</b> — <i>Yang Wang</i>	55
<b>Equitable Access To Green Spaces</b> — <i>Yining Feng</i>	57
<b>Food Waste In A First-Tier City, Beijing</b> — <i>Zihe Zhang</i>	59
<b>Stakeholder Engagement For Yangtze River Sustainability</b> — <i>Zijian Peng</i>	61
<b>Food Gardens In Low Income Communities</b> — <i>Zimo Fan</i>	63
<b>Regenerative Urbanism: Ecological Harmony</b> — <i>Zhangnian Sun</i>	65

# Finding Equity Within Urban Sprawl Solutions

Aasha Patel, Wilsonville High School, Wilsonville, USA

Urban sprawl is defined as the excessive spatial growth of cities into surrounding rural and natural landscapes (Brueckner, 2000). Current methods for containing urban sprawl are crude and unsustainable- one example is the establishment of Urban Growth Boundaries (UGBs), which are hard boundaries drawn by a city that developers cannot build past. In the case of Portland, Oregon, UGBs successfully limited spatial growth but raised housing prices, causing a surge in the homeless population (Brueckner, 2000). Adoption of mixed use spaces (i.e., developing housing in different zones) would mitigate this issue of excessive cost created by limited supply of residential property and high demand. However, construction is still an expensive task and renovation taxes would unequally impact lower-income areas (Brueckner, 2000). Clearly current policies regarding housing are outdated and efforts to reduce urban sprawl lean towards solutions that prioritize expediency over equity. Changing city codes to allow for zone ambiguity and an increase in the number of eco-friendly apartments (compared to houses) will contribute to a reduction in urban sprawl, improve sustainability within a city and foster an equitable urban environment through creation of affordable housing.

The first step to reducing urban sprawl is permitting the construction of more apartments. Currently, most American cities make it illegal to build anything other than detached homes on over 75% of land zoned for residential use (Minott, 2022). Deconstructing this policy to not restrict housing within a single zone is important to promote mixed-use development, which is proven to mitigate urban sprawl. Increasing the allotment of land that apartments can exist on is key to fighting this issue because of their modularity and compactness. By filling available spaces throughout different sectors with apartments, you compress the city into a denser sphere and provide residencies without unsustainably expanding the city. Auckland, New Zealand is experiencing severe urban sprawl, displaying some of the lowest housing densities in the world at 2,200 persons per square kilometer (ppk<sup>2</sup>). However, models project that by increasing the density of apartment-based housing within the city core, sprawl will be reduced, farmland and pastures (which are vital to the agrarian economy) will be preserved and the previously degrading UGB will grow (Evans, 2012). This myriad of benefits presents itself from the action of compacting the population, which apartment-based housing supports.

In addition, new development of apartments will simultaneously promote a greener city. Installing green apartment complexes in the vicinity of areas closer to the UGB that aren't traditionally zoned as residential increases walkability drastically by placing citizens closer to services. Building walkable communities is healthy for the environment because they reduce automobile-based transportation and lower overall carbon emissions per capita (Mashoodi, 2011). This combined with sustainable planning strategies are the key to paving a green future. Troppo Architects drafted a large-scale, stackable apartment that features passive technologies like climate regulation and lighting in addition to flexible add-ons like rooftop gardens (Mercer, 2007). This type of modular design supports smart growth strategies and is mindful of diversity in income levels. Baseline passive features are cheap to implement which means that regardless of financial status all apartments will be eco-friendly to an extent. Although rooftop gardens and solar panels are pricier technologies, the lack of them does not detract from the overall value that this type of design has on improving a city's carbon footprint.

Urban sprawl is also responsible for isolating communities and cultivating class gaps defined by non-equitable commute distances and lower spatial availability of services. Utilizing compact

housing counters these elements by providing affordable residencies and a closer proximity to inner-city services. I say apartments over houses because they are traditionally cheaper simply because they take up a lower acreage of space. In addition, the ecosystem services that apartment complexes can provide support residents both economically and socially. Within the complex, urban gardens, fitness centers and recreational facilities are beneficial to the mental health of a diverse array of residents. Citywide, blocks with a bi-functional mix of housing and amenities tend to also be located in the vicinity of employment opportunities, which aid families by providing economic stability (Mashoodi, 2011).

Despite the benefits, some could argue that financial equity isn't achievable because new construction involving ecological design close to the UGB is expensive (Brueckner, 2000). However, the passive technologies mentioned above tend to be cheaper than average utilities. Additionally, implementation of impact fees and adaptive financing models will lessen the burden of developing new buildings. Impact fees are government imposed charges that are calculated to offset infrastructure costs from new projects and are covered by private developers so that no additional financing is required (Brueckner, 2000). Adaptive financing models emphasize equitable pricing plans and once adopted will ensure that initial cost isn't a barrier to housing. These processes in conjunction with participatory decision-making processes and direct communication with historically excluded populations will ensure that these initiatives actually benefit marginalized communities (Rice, 2016). Citizen-government collaboration is key to not only installing equity but the continued advocacy for it as well.

As evidenced by the arguments above, it is entirely possible to thwart urban sprawl while providing equitable access to housing and services. Pushing municipal governments to increase the number of legal apartments on residential land is the first step, before challenging the concept of zoning altogether. Mixed-use development will pave the way towards a more sustainable future, environmentally and equitably.

#### References

1. Brueckner, J. K. (2000). Urban sprawl: Diagnosis and remedies. *International regional science review*, 23(2), 160-171.
2. Evans, B. (2012). Goodbye urban sprawl, hello apartments. Environmental Research Institute, University of Waikato.
3. Mashoodi, B., & Berghauer Pont, M. (2011, August). Studying land-use distribution and mixed-use patterns in relation to density, accessibility and urban form. In 18th International Seminar on Urban Form (pp. 1-19).
4. Mercer, T., Tuan, N. B., & Radford, A. (2007). What is affordable green housing? Analysis of a competition. *Journal of Green Building*, 2(1), 130-142.
5. Minott, O., & Selby, J. (2022, August 10). Ten Actions Cities Can Take to Improve Housing Affordability. Bipartisan Policy Center. <https://bipartisanpolicy.org/blog/10-actions-to-housing-affordability/>
6. Rice, M., & Hancock, T. (2016). Equity, sustainability and governance in urban settings. *Global health promotion*, 23(1\_suppl), 94-97.



# Infinite Solar Energy And Finite Uses

Andrew Nam, Emerson High School, McKinney, Texas, US

Photovoltaic (PV) energy, also known as solar energy, is a leading sustainable energy source with the potential to be the main power source in densely populated areas because its potential energy is infinite as the sun continues to shine. A comparative study on world energy consumption released by the International Energy Agency (IEA) shows that in 2050, solar array installations could supply around 45% of the energy demand in the world (Mekhilef, 2011). However, inadequate solar panel installation practices and the wrong installation of solar panels and the lack of solar power policies are limiting the solar energy use. Further innovation is needed to improve the energy's accessibility and efficiency. Flexible installation with the expansion of the RPS (Renewable Portfolio System) policy offers a promising solution to increase the accessibility of solar panels, supporting the adoption and innovation of this technology as a clean energy solution.

The materials in solar panels have a significant impact on electric efficiency, durability, location for installation, and cost. The two main types of solar panels are crystalline panels and thin-film panels. Crystalline is manufactured by melting the silicon and setting it in a square cast. Thin-film panels mostly use Copper Indium Gallium Selenide (CIGS) (Thopil, 2020). In sunny and coastal regions in summer, thin-film PV modules will perform better than crystalline silicon PV modules, while in high locations and during the winter season crystalline silicon-based PV modules perform better than thin film because of the temperature coefficients. Thin-film modules can be realized to be used in architecture (flexible, semi-transparent, etc.) because they are not very sensitive to temperature and can be transparent (Mercaldo, 2009). Thin-film window panels are ideal for urban areas where there are various tall buildings. It can bring an advantage in that it does not block the light and the windows are not blocked and can be used. Since crystalline panels have more electrical efficiency and need smaller space than thin-film panels, it is an efficient method, in small amounts, at high altitudes in the city.

Photovoltaic panels are sometimes ineffective because they can only be fixed at a specific angle. But we can easily overcome this problem by using a sun-tracking solar panel system (Chowdhury, 2017). There are fixed Tilt Arrays, single-axis trackers, and dual-axis trackers to install solar panels. Using a fixed tilt and single-axis sun-tracking solar panel system is a better option than a dual-axis sun-tracking solar panel system because they are cheaper (Chowdhury, 2017). To construct the crystalline solar panel system in the city by using fixed-tilt arrays or single axis, the use of empty space at the top of the building, and the parking lots in the city. Empty spaces such as spaces between buildings, parks, flat and high-altitude building roofs, parking lot roofs, and other vacant spaces in cities are the potential space for the installation of solar panels. It is not just a roof of tall buildings, it can be installed on the roofs of single-family homes and parking lots, but also on the roofs of various public places such as libraries, schools, indoor pools, shopping malls, or else, so that everyone can easily access solar energy. Using empty spaces and the proper arraying way can be another important consideration.

Though materials and installation plans are important, they cannot be effective without an extension of the RPS policy. It is a system that obligates power generation companies above a certain scale to supply a certain percentage or more of the total power generation as renewable energy power. For example, Korea's RPS was implemented beginning in 2012, and it has since been revised. The RPS requires generation companies with over 500 MW of capacity to procure a minimum of 10% of "new" and renewable energy by 2023 (Heeter, 2019). The expansion of the RPS policy is to soon

reduce the percentage of fossil fuel energy use and further increase the percentage of renewable energy use. Expanding the RPS policy can encourage different energy companies to use renewable energy. Furthermore, if it expands to an international RPS policy, it will be possible to exert a positive influence internationally, such as by providing solar energy to energy-deficient countries and countries with very little access to solar energy. After solar energy is positioned as the main energy and such policies are successfully implemented, there is a great possibility that a sustainable Earth can be created.

Although these proposals have the potential to change the world, they would present some problems for the city. Lack of space, losing the beauty of the city, the economic burden to government and companies, and perhaps social conflict. Also, high energy pay-back time and the reflected light is polarized and it victimizes millions of insects and birds are other possible problems (Kadar, 2014). However, the PV energy system is the easiest renewable technology to produce energy and the representative alternative energy as pollution-free, noise-free, and infinite energy. As long as the sun does not disappear, it can be said that it is an infinitely usable energy.

As the share of solar energy continues to rise, solving such solar energy use problems is becoming more important and urgent. This paper has argued for flexible installation according to the type of solar panels, optimized Installations in the proper place, and the policy that can make the Earth be sustainable. By prioritizing efficiency, sustainability, and equity, our societies can improve cities and our lives.

## References

1. Mekhilef, S., Saidur, R., & Safari, A. (2011). A review on solar energy use in industries. In *Renewable and Sustainable Energy Reviews* (Vol. 15, Issue 4, pp. 1777–1790). Elsevier BV. <https://doi.org/10.1016/j.rser.2010.12.018>
2. Thopil, G. A., Sachse, C. E., Lalk, J., & Thopil, M. S. (2020). Techno-economic performance comparison of crystalline and thin film PV panels under varying meteorological conditions: A high solar resource southern hemisphere case. In *Applied Energy* (Vol. 275, p. 115041). <https://doi.org/10.1016/j.apenergy.2020.115041>
3. Mercaldo, L. V., Addonizio, M. L., Noce, M. D., Veneri, P. D., Scognamiglio, A., & Privato, C. (2009). Thin film silicon photovoltaics: Architectural perspectives and technological issues. (Vol. 86, issue10, pp.1836–1844). <https://doi.org/10.1016/j.apenergy.2008.11.034>
4. Chowdhury, K. I., Bakshi, P. S., & Alam, Md. I. (2017). Performance Comparison Between Fixed Panel, Single-axis and Dual-axis Sun Tracking Solar Panel System [https://dspace.bracu.ac.bd/xmlui/bitstream/handle/10361/9118/12221046%2c%2012221071%2c%2012121101\\_EEE.pdf?sequence=1](https://dspace.bracu.ac.bd/xmlui/bitstream/handle/10361/9118/12221046%2c%2012221071%2c%2012121101_EEE.pdf?sequence=1)
5. Heeter, Jenny S, Speer, Bethany K, & Glick, Mark B. International Best Practices for Implementing and Designing Renewable Portfolio Standard (RPS) Policies. United States. <https://doi.org/10.2172/1507986>
6. Kádár, P. (n.d.). Pros and cons of the Renewable Energy Application - KIFÜ. [http://epa.niif.hu/02400/02461/00050/pdf/EPA02461\\_acta\\_polytechnica\\_hungarica\\_2014\\_04\\_14.pdf](http://epa.niif.hu/02400/02461/00050/pdf/EPA02461_acta_polytechnica_hungarica_2014_04_14.pdf)



# Shenzhen's Green Renaissance

Bohan Hu, Shenzhen College of International Education, Shenzhen, China

As cities worldwide face climate change and urbanization, they are realizing the importance of sustainability, prompting transitions to greener, sustainable urban landscapes. For instance, New York's initiative ensures every resident has a park within a ten-minute walk (Beatley, 2011). However, environmental awareness often correlates with income and education levels. With the fact that 75% of the total population in Shenzhen lives in urban villages, usually considered low-income, concerns about maintaining equitable environment-related recognition among city residents gained great attention. Compelling research finding that urban green spaces, like the park, allow low-income residents nearby to raise their awareness of the environment (Sodhi et al., 2010), I propose that Shenzhen's government can boost environmental awareness among often neglected urban village communities through the construction of green spaces to improve disproportionate environmental awareness in society.

Firstly, constructing more accessible green spaces enables urban village inhabitants to appreciate the health benefits of such environments, thus improving their environmental awareness. Parks, as centers for physical activity, can improve public health and reduce chronic diseases like obesity (Wolch et al., 2014). Similarly, the proximity to parks encourages exercise. Moreover, the impact of urban green spaces on mental well-being is substantial, offering stress relief, tranquility, and exposure to nature. Therefore, by providing both physical and mental health improvement, the government's development of urban green spaces can serve as a potent tool for heightening the environmental awareness of economically disadvantaged citizens. However, it is crucial to consider potential health risks such as air pollution exposure near parks and safety concerns in parks in heavy traffic regions (Wolch et al., 2014).

Secondly, government-provided opportunities for public participation in the planning of urban green spaces can enhance environmental awareness among urban village residents. Such participation serves as an educational tool, informing residents about nature conservation and urban land use, thereby fostering an informed community and engendering a sense of ownership among its members (Loures and Crawford, 2008). This sense of contribution and involvement can increase residents' willingness to spend time in these green spaces, strengthening their bond with nature. Moreover, civic participation helps resolve planning conflicts, avoids delays, and allows the government to understand local cultures better. Thereupon, it can further enhance citizens' environmental awareness. Nonetheless, it is important to note that urban village inhabitants may lack familiarity with urban planning concepts. Consequently, the public participation process could overlook critical aspects of justice and sustainability in planning urban green spaces (Pacione, 2014).

Thirdly, the government can partner with non-governmental organizations (NGOs) to enhance the delivery of urban green spaces in urban villages, thereby elevating environmental awareness. NGOs can make valuable contributions to urban village green development due to their specialized project focus and ability to ensure project stability (Kou et al., 2019). They can provide educators to impart sustainability-related knowledge to village residents, maintain green spaces, and even expand the project to other urban villages in Shenzhen. For instance, given the constrained space in the Gangxia urban village of Shenzhen, an NGO implemented urban green roofs as an innovative solution. By hosting community activities like concerts and exhibitions, green roofs provide urban village residents with direct exposure to nature, allowing them to experience its beauty firsthand and

boosting their environmental awareness. However, NGOs' involvement may sometimes diverge from the government's mission, as they may utilize resources to pursue their own agendas (Foo, 2018).

One could argue that the construction of more urban green areas around urban villages could potentially lead to gentrification, resulting in the displacement of existing residents as rents and the cost of living increase due to the influx of wealthier residents (Anguelovski, 2016). However, this issue can be effectively addressed through government interventions. For example, the Shenzhen government has recently taken steps to mitigate the impact of gentrification. They have implemented an intermediary business model between house owners and renters. In this model, the government rents houses from owners and provides them to original residents at a lower rent. Additionally, subsidies are provided to support these residents. By implementing such measures, the Shenzhen government is actively working to resolve the issue of gentrification and ensure the well-being of the existing community.

Fostering environmental awareness in urban villages hinges on creating accessible green spaces, encouraging public participation in planning, and collaborating with NGOs. However, these must consider potential challenges, such as urban planning unfamiliarity and divergent NGO agendas. Equally critical is mitigating gentrification to prevent displacement of existing residents. Shenzhen can serve as an example, balancing green space development and community well-being. As we move towards sustainable urban landscapes, such balanced and inclusive approaches are vital for the equitable distribution of environmental awareness.

## References

1. Beatley, T. (2011). *Biophilic cities: Integrating nature into urban design and planning*. Island Press.
2. Sodhi, N. S., Lee, T. M., Sekercioglu, C. H., Webb, E. L., Prawiradilaga, D. M., Lohman, D. J., ... & Ehrlich, P. R. (2010). Local people value environmental services provided by forested parks. *Biodiversity and conservation*, 19, 1175-1188.
3. Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and urban planning*, 125, 234-244.
4. Loures, L., & Crawford, P. (2008). Democracy in progress: Using public participation in post-industrial landscape (re)-development. 4(9).
5. Pacione, M. (2014). The power of public participation in local planning in Scotland: the case of conflict over residential development in the metropolitan green belt. *GeoJournal*, 79, 31-57.
6. Kou, H., Zhang, S., & Liu, Y. (2019). Community-engaged research for the promotion of healthy urban environments: A case study of community garden initiative in Shanghai, China. *International journal of environmental research and public health*, 16(21), 4145.
7. Foo, K. (2018). Examining the role of NGOs in urban environmental governance. *Cities*, 77, 67-72.
8. Anguelovski, I. (2016). From toxic sites to parks as (green) LULUs? New challenges of inequity, privilege, gentrification, and exclusion for urban environmental justice. *Journal of planning literature*, 31(1), 23-36.

# Urban Farming: An Oasis In The Food Desert

Brennan Cleary, Mt Lebanon High School, Pittsburgh, USA

There are three things that we cannot survive without: air, water, and food. The world has struggled these past couple of years, especially with food security. According to the U.S. Global Leadership Coalition, the number of people in the world who have severe food insecurity has doubled to 276 million people. The World Food Program estimates that this number will rise to 323 million people by the end of 2022, due to ongoing social, economic, and political crises around the world (U.S.G.L.C, 2022). For example, areas in the United States that suffer the most from food insecurity are neighborhoods of color, immigrants, minorities, and other neglected groups. However, there is a solution to food insecurity: urban farming. Unlike traditional farming, urban farming can be conducted in more compact areas, such as the urban center. The establishment of more urban farms offers a promising solution to weaken hunger and food insecurity, and this paper proposes that encouraging more people to create urban farms, in forgotten and unused areas, is a propitious approach to fight a war on hunger and end food insecurity for good.

Urban farming is an obvious solution to urban food deserts, but it is also a hidden solution to supply chain issues. During COVID-19, supply chains were heavily impacted. At the start of the pandemic, many items were gone from store shelves. According to a study by Michail and Melas that analyzes how coronavirus affected the shipping industry, the economic index for dry bulk cargo carriers decreased by .03% every time Covid cases increased by 1% (Michail and Melas, 8). Dry bulk cargo carriers carry everything that our society needs in order to function. Port calls also decreased for dry bulk cargo carriers, because of lockdown restrictions. Since cargo ships couldn't dock at ports, this means that there was no need to ship goods out in the first place, since they would spoil and couldn't be used. With urban farming, however, the supply chain disaster can be prevented from occurring again.

Urban farming has also been proven to work, and is already in use. In Nairobi, Kenya, 47% of the city's population live in one of the low-income areas of the city. Urban poverty also increased in the 80's and 90's (Foeken and Mwangi, 2). But, people are perseverant. In the mid 80's, 20% of Nairobi households were growing crops within city limits, and 7% were keeping livestock. Urban farming is heavily concentrated in poorer households, which was confirmed by a study from 1994, where 30% of households could be classified as urban farmers (Foeken and Mwangi, 2). Families grow food wherever they can, in order to survive. If a family's breadwinner has a low income, the income is often used on food. But urban farming ensures a stable food supply, and families can use their income for other necessities.

Supply chains have proven to be ineffective, especially in global emergencies, and urban farming has already proven to be effective in urban environments, as evidenced by Kenya. So, how can we implement it into our cities? Rooftops of buildings are commonly viewed as unusable, except for utilities and protection from the elements. But with green roof farming, the roof instead benefits the community. A paper for the Hainan China World Green Roof Conference in 2011 describes the environmental, economic, and social sustainable benefits. Environmentally, an overall improved quality of urban living is achieved. Economically, there is an increase in the overall food supply, a decreased building utility cost, and an increase in building value. The community also interacts with each other more, through local employment, and helping of the poor, along with gaining a common area to gather in (Hui, 2). The green roof is an easy to implement solution to many social and environmental problems, but the easiest problem it can tackle is food deserts, as the green roof can

act as an urban farm, when needed. Urban farming can also occur inside abandoned buildings as well. A case study on this topic mentions an old industrial site in the metropolitan city of Bologna, in Northern Italy. The site used to be a chemical plant from the 1940s to 1999. The new site, proposed as “Galliera Kitchen Park”, will include an environmental street, a community garden, a floating garden on a canal, and a market street, where crops grown in the park are sold to local citizens. (Elbardisy et al.) If this was established in other areas, they too could become reborn. For example, Detroit used to be the hub of American automaking, but it has fallen into disarray. With urban farming, however, it could become a hub for a new type of commercial agriculture, providing both food and jobs for its residents.

While some may argue that urban farming is a waste of space, and that a food supply should not be grown in the busy urban center, the positives far outweigh the negatives. Urban farming can be conducted in numerous ways. The most efficient and safe way would be combining vertical farming with aeroponics. Vertical farming involves stacking plant beds on top of each other, maximizing efficient usage of space. Aeroponics is beneficial, because plant to plant contact is reduced and each spray can be sterilized. Even if a plant is infected, it can easily be removed without endangering the rest of the crop. More plants can also be grown per square meter, due to the disease free environment.

Urban farming is an effective solution to many problems that our cities face today. It becomes an effective food supply, allows us to use abandoned buildings, brings people together, prevents supply chain collapses, and decreases the food journey. If applied commercially, a brand new industry opens up, creating more jobs, and giving entire communities a second chance, and a brighter future. But, even without its application to economics, urban farming can eliminate food deserts for good, end global hunger and food insecurity, and prevent supply chains from collapsing, like they did during the COVID-19 pandemic.

## References

1. U.S. Global Leadership Coalition. (2022, April). COVID-19 Brief: Impact on Food Security. U.S. Global Leadership Coalition. Retrieved June 23, 2023, from <https://www.usglc.org/coronavirus/global-hunger>
2. Elbardisy, A., William, Y., Sherif, M., Aboulmaga, M., & Guedes, M. (n.d.). Sustainable refurbishment of abandoned urban areas: The case study of former SIAPA area, Galliera – Bologna, Italy. IOP Conference Series: Earth and Environmental Science, 1-10. <https://iopscience.iop.org/article/10.1088/1755-1315/863/1/012014/pdf>
3. Foeken, D., & Mwangi, A. M. (n.d.). Increasing food security through urban farming in Nairobi. City Case Study Nairobi, 1-25.
4. Hui, S. C. (n.d.). Green roof urban farming for buildings in high-density urban cities. Invited Paper for the Hainan China World Green Roof Conference 2011, 1-9. <https://hub.hku.hk/bitstream/10722/140388/1/Content.pdf>
5. Michail, N. A., & Melas, K. D. (n.d.). Shipping markets in turmoil: An analysis of the Covid-19 outbreak and its implications. Elsevier, 1-9. <https://doi.org/10.1016/j.trip.2020.100178>

# Tackling The Urban Digital Divide

Brian Guo, Canyon Crest Academy, San Diego, California

In the current digital age, access to the internet is no longer a luxury; it is a necessity that enables people to communicate, learn, explore new economic opportunities, and so much more. Unfortunately, there is currently a digital inequality where marginalized communities have limited access to these essential digital resources. In 2021, about four-in-ten adults with lower incomes did not have a desktop or laptop computer (Pew Research Center, 2021). In addition, the COVID-19 pandemic forced schools and workplaces to move online, which has only worsened the already drastic divide. It is clear that equal access to this vital resource is essential to cultivate an inclusive environment that encourages social and economic mobility. When there is more digital inclusiveness, government and community policies for all matters, not just sustainability, can be delivered more effectively because of greater access to information, online services, and community engagement (United Nations, n.d.). Recognizing the challenges posed by the digital divide, this paper argues that a holistic approach by governments and communities to increase access to both devices and internet will not only be a critical step towards closing the divide, but also be indispensable for fostering social equity.

The first part of the digital divide is the devices themselves, which can be a complex issue. Many high tech devices, such as computers, smartphones, and tablets, are out of reach for many low-income citizens because devices are not affordable. Implementing policies to address this unique digital divide requires government intervention beyond what exists in cities currently (Sanders and Scanlon, 2021). Government subsidies or financing schemes for electronic devices should be implemented similar to how they subsidize basic utilities or healthcare. Furthermore, businesses and individuals should be incentivized with tax benefits to donate old devices. Such devices, otherwise considered e-waste and thrown away, will be refurbished and distributed to those who need it most. One case study in Egypt shows how even slightly expanding access to mobile phones has greatly improved an individual's ability to access information, communicate with others, and participate in the economy, even in areas with limited infrastructure in place (Warschauer, 2003). By simply distributing more hardware, communities will benefit tremendously. Moving beyond making devices cheaper, education and awareness is crucial. When they receive their devices, citizens should be taught through infographics so they can navigate the digital world most effectively. Additionally, when more people gain access to the web, they become more sustainable and informed. Ultimately, addressing the shortage of digital devices in urban cities is an important first step to bridge the digital gap.

The challenge of fixing the digital divide problem in urban cities goes beyond simply providing devices. What use is a digital device if one is unable to access the web? The cost of internet forces low-income households to make tough choices between the web and other essential needs (Goggin, 2014). But there are solutions to this problem. The government can enact regulations that prevent internet providers from charging too high and establish tax incentives for internet service providers who offer discounted rates to low-income households (Goggin, 2014). But the best solution to the problem would be public wifi networks. They are lifelines that provide access to a plethora of digital services for those still under the poverty line (El-Omari and Alzaghaf, 2010). But they are not perfect because there are still areas where internet connectivity is spotty. Initiatives to create and expand public Wi-Fi areas ensure that even the most disadvantaged can have a reliable connection. This fosters a greater sense of community and identity which contributes to urban sustainability. By implementing these strategies, urban cities can make sure everyone has the opportunity to participate in our ever growing digital realm.

As with all proposed plans, the cost and feasibility of implementing such a comprehensive strategy. Critics may argue that expanding public Wi-Fi networks, improving infrastructure, promoting digital literacy, and ensuring affordability would require significant funding (El-Omari, N., and Alzaghal, M., 2010). However, for many governments and businesses it is better for more people to have access to technology, meaning they would be more inclined to use resources to fix the issue. There should and can be a reallocation of funding from another section. Moreover, access to digital services can improve education, healthcare, and civic participation, leading to a more inclusive, equitable, and sustainable society. This digital inclusion will contribute to the overall economic growth and development of urban cities (Mora-Rivera and Garcia, 2021).

The digital divide in urban cities is a pressing issue that disproportionately affects marginalized communities, limiting their access to essential digital resources and hindering their social and economic mobility. This paper has argued for a multi-pronged approach to address this issue, including expanding public Wi-Fi networks, promoting digital literacy, and ensuring affordability of internet plans. Although this paper has focused on government policies, civic participation from individuals, NGOs, and businesses can push for change just as much. Looking towards the future, it is crucial that we continue addressing the digital divide and exploring new ways to ensure that all citizens have equal access to digital resources and are informed on any new policies. By prioritizing digital equity and urban sustainability, we can work towards creating a more inclusive and prosperous future for all.

## References

1. Pew Research Center. (2021, June 22). Digital divide persists even as Americans with lower incomes make gains in tech adoption. Retrieved from <https://www.pewresearch.org/short-reads/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/>
2. United Nations. (n.d.). The Age of Digital Interdependence. Retrieved from <https://www.un.org/en/pdfs/DigitalCooperation-report-for%20web.pdf>
3. Sanders, C. K., & Scanlon, E. (2021). The Digital Divide Is a Human Rights Issue: Advancing Social Inclusion Through Social Work Advocacy. *Journal of human rights and social work*, 6(2), 130–143. <https://doi.org/10.1007/s41134-020-00147-9>
4. Warschauer, M. (2003). *Technology and Social Inclusion: Rethinking the Digital Divide*. The MIT Press. DOI: <https://doi.org/10.7551/mitpress/6699.001.0001>
5. Goggin, G. (2014). New ideas for digital affordability: Is a paradigm shift possible? *Australian Journal of Telecommunications and the Digital Economy*, 2, 4.
6. El-Omari, N., & Alzaghal, M. (2010, March 25). Exploiting Wireless Technologies Infrastructure for Digital Inclusion in Jordan.
7. Mora-Rivera, J., & Garcia, F. (2021). "Internet access and poverty reduction: Evidence from rural and urban Mexico." *Telecommunications Policy*, 45(2), 102076. <https://doi.org/10.1016/j.telpol.2020.102076>



# Smart Cities And Citizen Engagement

Chenhui Mou, Shanghai World Foreign Language Academy, Shanghai, China

In an era of rapid urbanization and technological advancements, smart city technologies offer the potential to enhance urban environments and improve the quality of life for residents. However, beyond their technical aspects, citizen engagement and participatory decision-making are crucial for the success of smart cities. This research explores how smart city technologies enable meaningful interactions between residents and local governments. Examples include Barcelona's implementation of sensor networks for waste management and energy efficiency (Harrison, Marshall, and Todes, 2016), and Singapore's smart urban mobility systems improving transportation (Goh, Chan, and Ho, 2016). Specific aspects covered include urban planning, resource management, and public service delivery, empowering communities to contribute to decision-making and improve urban living.

Smart cities that prioritize citizen engagement as a core component of urban development hold the potential to address environmental, social, and ecological challenges by fostering inclusive decision-making, collaboration, and resource optimization. By involving residents from diverse backgrounds in decision-making processes, smart cities empower individuals to actively participate and contribute to the shaping of their communities. Research conducted by Smith et al. (2019) highlights the importance of inclusive engagement in promoting a sense of ownership and responsibility among citizens, leading to more sustainable urban outcomes. When residents are involved in shaping policies and initiatives, their diverse perspectives contribute to better-informed decisions that address the specific needs and aspirations of communities. For example, the city of Barcelona implemented the "Decidim Barcelona" platform, which allows citizens to participate in decision-making on various urban issues, resulting in more inclusive and effective policies.

Citizen engagement in smart cities goes beyond active participation and also leverages technology to optimize resource allocation and improve environmental sustainability. Nam and Pardo (2019) suggest that citizen engagement enables real-time data collection through sensor networks and the Internet of Things (IoT), facilitating evidence-based decision-making. By actively involving residents in monitoring and managing resources, such as energy consumption and waste management, smart cities can enhance efficiency and reduce environmental impact. Singapore's "Smart Nation" initiative serves as an example of citizen engagement through the use of smart grids, enabling residents to monitor their energy usage and make informed choices to reduce their carbon footprint.

Moreover, citizen engagement in smart cities promotes social equity by ensuring that urban development benefits all segments of society. Davidson and Yu (2020) emphasize that citizen engagement creates opportunities for dialogue, fostering a more inclusive and participatory urban governance model. By actively involving marginalized and underrepresented communities, smart cities can address social inequalities and promote inclusivity. In the city of Medellín, Colombia, citizen engagement initiatives have been implemented in historically marginalized neighborhoods, allowing residents to voice their concerns and shape urban policies to better serve their needs.

However, some argue that citizen engagement in smart cities may exclude certain groups, particularly those with limited access to technology or digital literacy. While digital inclusion is an important concern, initiatives are underway to bridge the digital divide and ensure equitable access to technology. Davidson and Yu (2020) suggest that programs providing digital literacy training and community access points can be implemented in cities. Additionally, partnerships between governments, NGOs, and community organizations can facilitate technology adoption and support

disadvantaged communities in engaging with smart city initiatives. By addressing the barriers to digital inclusion, smart cities can ensure that citizen engagement is accessible to all residents, promoting equity and inclusivity.

In conclusion, smart cities, underpinned by citizen engagement, offer a promising pathway to address urban social-ecological challenges. By fostering inclusive decision-making, resource optimization, and social equity, these cities can promote sustainability, livability, and environmental stewardship. It is imperative to bridge the digital divide and ensure equitable access to technology, allowing all residents to actively participate in shaping the future of their cities. By embracing citizen engagement, smart cities have the potential to transform urban environments into sustainable and equitable spaces, where residents are empowered to contribute their insights and collaborate towards a more inclusive and prosperous future. Through collective action and the integration of technology, smart cities can pave the way for a sustainable and equitable urban future.

## References

1. Bastos, D., Fernández-Caballero, A., Pereira, A., & Rocha, N. P. (2022). Smart City Applications to Promote Citizen Participation in City Management and Governance: A Systematic Review. *Informatics*, 9(4), 89. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/informatics9040089>
2. Horgan, D., & Dimitrijević, B. (2019). Frameworks for citizens participation in planning: From conversational to smart tools. *Sustainable Cities and Society*, 48, 101550. Chicago

# Air And Waste Pollution In Minority Areas

Christina Mink, Portledge, Dix Hills, U.S.A

Many minority groups, such as Black/Latino and low-income communities disproportionately suffer from increased air pollution and waste in their communities. Poor communities are more likely to be located closer to environmental hazards such as landfills, medical waste incinerators, diesel bus depots, and superfund sites. Because of this, these populations tend to suffer more health problems, including asthma and cancer (Gwyen, 2001). This is something that needs to be changed. If the health and cleanliness of certain areas are neglected, then ecological sustainability as a whole will be negatively impacted. To aid this problem, civic engagement with the environment must be increased, so that people will be more willing to help the environment. In addition, if the members of disadvantaged communities are to speak up and communicate with the government, this can allow for their concerns about air and waste pollution to be accounted for. To give minority groups the clean city they deserve, governments need to increase civic engagement with the addition of green spaces and education, plus involving community members in governance to give them a bigger voice.

Green spaces can greatly increase rates of civic engagement among Black/Latino and low-income communities. Along with green spaces having the direct benefit of improving car traffic, pollution mitigation, oxygen generation, noise reduction, air cooling, microclimate regulation, and carbon sequestration (Bolund and Hunhammar, 1999), park managers can hold cultural and volunteering events can allow them a way in which they can actively engage in helping the environment. People that are a part of these communities can volunteer to help clean the spaces and manage the plants. If the people are surrounded by nature, they will be more likely to appreciate and want to protect it. Organizing cultural events can create a good place to socialize and increase people's connections with nature, increasing their interest in helping the environment (Beately, 2011). A population must be interested in helping the environment if a change in the air and waste management within their community was to be made. It provides a great place to connect with others that also want to improve the environment, giving them opportunities to come together and advocate for better waste management and air quality regulation. While civic engagement alone can make a large difference, without government support, communities can only get so far. This is where governance comes into play.

With low-income and minority communities actively working for a cleaner neighborhood, they can have the opportunity to further assert their influence through the government using governance. Governance gives more governmental power to non-governmental parties, such as NGOs and social movements. Civic engagement is essential for governance to work because people must be interested in improving their city's ecosystem to influence and make informed decisions on these problems. With governance, people who want to address these issues in their community can meet together and discuss how much money of a set amount of budget can be spent on creating green spaces, and better waste management facilities (Escobar 2017). With this strategy, air and waste pollution can be mitigated by tightening waste disposal regulations, disposing of waste more often, and relocating the waste facilities (Orloff 2003). Giving disadvantaged communities a larger voice with governance will give them the power to address the inequality they have been facing with air and waste pollution.

For Black/Latino and low-income communities to make more informed decisions on how to reduce air and waste pollution, governments must provide proper environmental education to both young students and adults. This can be done by strengthening climate education in school

curriculums and holding government seminars. It is important to inform the public of the health and climate impacts of pollution, which can help motivate the community to participate in community engagement events related to these issues. According to Shaman (2017), experts can be invited to educate about urban planning and how it can be attributed to pollution.

Health professionals, policymakers, urban planners, engineers, and corporate leaders all need more formal exposure to and education in climate science, public health, and the ways that climate change and health intersect.

This type of education can raise more awareness among those exercising governance and civic participation about how their actions can help and influence their community and government to better air and waste pollution infrastructure.

Black/Latino and low-income communities suffer from more air and waste pollution compared to other communities. Due to the negative health impacts these people suffer from, and the negative impact pollution has on climate and urban sustainability as a whole, this problem should not be ignored. Adding more green spaces in disadvantaged areas can help alleviate pollution. Green plants can reduce CO<sub>2</sub> and improve air quality, while also increasing civic engagement by bringing them closer to the environment. Governance also gives these communities a larger influence to improve air quality and waste management by giving them a voice in the government and providing them with better environmental education can give them the knowledge to help their community more efficiently. It is important to remember that in pursuit of urban sustainability, the less fortunate communities should not be left behind.

## References

1. Gwynn, R. C., & Thurston, G. D. (2001). The burden of air pollution: Impacts among racial minorities. *Environmental Health Perspectives*.
2. Bolund, P. and Hunhammar, S. 1999. Ecosystem services in urban areas. *Ecological Economics* 29: 293-301. Brack, C. L. 2002. Pollution mitigation and carbon sequestration by an urban forest. *Environmental Pollution* 116(S1): 195-200.
3. Beatley, T. (2011). *Biophilic cities: Integrating nature into urban design and planning*. Washington, DC: Island Press.
4. Orloff, K., & Falk, H. (2004, November 14). An international perspective on hazardous waste practices. *International Journal of Hygiene and Environmental Health*.  
<https://www.sciencedirect.com/science/article/pii/S1438463904702254>
5. Shaman, J., & Knowlton, K. (2018, April 26). The need for climate and Health Education | *AJPH* | Vol. 108 issue S2. A Publication of the American Public Health Association.  
<https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2017.304045>

# City Disasters: How To Preserve Equity

Daniel Dixon, Cornell University, Ithaca NY, United States

“Over the past decade, over 300 natural disasters occur yearly around the world affecting millions and costing billions” (Prasad and Francescutti, 2017). With natural disasters rising in frequency, it becomes critical that we investigate how to prevent human casualties and improve building endurance; all while using sustainable actions to realize it. Applying sustainable concepts to this idea will act not only to promote the safety of social statuses who require resource assistance but also to limit destruction and the resources needed during aftermaths. Achieving these goals is possible by creating city escape plans, building preservation shelters, and prioritizing the longevity of these structures. If city officials and local organizations commit to these three principles, then there will be hope for limiting the devastation of humans, increased inequity, and the destruction of cities.

City transportation has limitations, especially for people that need assistance, which becomes even more evident during natural disasters. One article details examples of these issues, “Planning mass evacuations in large urban areas after a natural hazard occurs is a difficult and complex task. It depends on many factors like the intensity of the earthquake, human behavior, the geography of the area, and the distribution of the population, among others” (Munoz et al., 2022). With these consequences, cities are left in chaos and citizens are unable to escape the city with their livelihoods. Yet, we can prevent or limit this with future planning. Research suggests this, “simulation is a powerful tool for evacuation policies... It can be used for tasks, such as identifying problems in evacuation (e.g., obstacles or streets congestion), including elements of safety into urban planning, improving procedures, and reducing evacuation times” (Munoz et al, 2022). Using advanced simulations presents efficiency for city evacuation plans. The implications here also limit vehicle usage and fossil fuels. Investing in this would apply to vehicle congestion during times of tranquility. By using this, we can prevent casualties from storms and environmental effects of vehicle presence.

Disaster shelters, which are created with the intention to save the lives of all people, can either be non-prevalent or fail to live up to their purpose. One article cites, “In Port-au-Prince, 20 months after the earthquake, the rebuilding of homes... had fallen far short of need, with between 375,000 – 680,000 people still living in makeshift shelters” (Sanderson and Jeni, 2014). In this case, there was no shelter for displaced survivors, which challenges sustainability for both people and cities. A lack of shelter protection causes consequences such as preventing reconstruction, regrowth, and safety (mental and physical). This leaves cities and people in a state of prolonged disorder. The environment can also be afflicted by fallen shelter debris that may not be recovered properly, which presents other health consequences. Multipurpose shelters offer solutions to the challenges facing the sustainability of people and cities. One article describes these structures, “During normal times, these shelters are used as schools and community centers... which include coastal afforestation” (Khan, 2008). If designed correctly, sustainable multipurpose shelters provide safety for disadvantaged citizens during disasters but also provide social assistance at all other times.

Oftentimes the disaster is not the most fatal problem, instead, it can be the buildings that fail because of the disaster's strength. This quote discusses this, “natural disasters in Turkey since the beginning of the 20th century resulted in 87,000 casualties, 210,000 injuries, and 651,000 heavily damaged or destroyed homes” (Gunes, 2015). Another problem arises with the resources needed for this. The same article says, “The concrete failed... values below 10 MPa are not uncommon... As important as the strength of concrete is the strength and ductility of the reinforcing steel used in buildings” (Gunes, 2015). These two products that are crucial for building stability are the two that fail

most often, which end up harming people and polluting the environment. A solution to this lies with reused materials, "By mixing paper waste with glue, creating the alternative for bricks... The paper brick that he creates is stronger than conventional brick, making the building... stronger than conventional ones" (Statasig, 2018). This saves lives and resources while keeping equitability for disproportionately affected cities.

Why is it worth living in cities, especially if they face repeated disasters and increased casualties? One article outlines this, "The 2004 Indian Ocean tsunami, the 2010 earthquake in Haiti, and the 2011 tsunami in Japan... Together, accounted for 471 346 deaths, costing hundreds of billions of dollars" (Prasad and Francescutti, 2017). Despite these facts, we cannot accept it as inevitable. This is especially evident since humans are capable of learning from mistakes. Every year, technology advances and we become more capable of dealing with these problems. Advancements, such as the ones detailed throughout this article, are the solutions we need to move forward with. Admitting defeat would prevent learning curves from disasters and would promote abandoning the benefits that we can get from cities.

After this essay, it should be clear why it's more critical than ever to act. We must prevent deaths from these disasters, create building endurance, and use sustainable actions to optimize it. Objectives such as city escape plans, preservation shelters, and structure longevity are plenty capable. If we can learn from our past mistakes, we can prevent human mortality, any increased inequity, and the destruction of cities. These suggestions safeguard cities from disasters, while also promoting their flourishing in times of tranquility.

## References

1. Astudillo Muñoz, G., Gil-Costa, V., & Marin, M. (2022). Efficient simulation of natural hazard evacuation for seacoast cities. *International Journal of Disaster Risk Reduction*, 81, 103300.
2. Gunes, O. (2015). Turkey's grand challenge: Disaster-proof building inventory within 20 years. *Case Studies in Construction Materials*, 2, 18–34.
3. Prasad, A. S., & Francescutti, L. H. (2017). Natural Disasters. *International Encyclopedia of Public Health*, 215–222.
4. Sanderson, D., Sharma, A., Kennedy, J., & Burnell, J. (2014). Principles, Practice and Lessons From Haiti for Urban Post-Disaster Shelter Recovery Programs. *Asian Journal of Environment and Disaster Management (AJEDM) - Focusing on Proactive Risk Reduction in Asia*, 06(02), 131–151.
5. Sataksig. (2018, October 29). Green Earthquake-Proof Architecture Innovation. Earth Buddies. <https://earthbuddies.net/green-earthquake-architecture/>
6. Shah Alam Khan, M. (2008), "Disaster preparedness for sustainable development in Bangladesh", *Disaster Prevention and Management*, Vol. 17 No. 5, pp. 662-671.



# Green Gentrification

Eugene Kwon, Samueli Academy, Tustin, United States

As the world's environmental crisis worsens, many countries are attempting to create more and more green spaces throughout their city. In fact, in Europe, the "greenness" of cities has increased by 38% over the last 25 years (Melchiorri, 2019). Of course, the intention of such green spaces is to enhance the environment and to build an area for community members to enjoy and interact. However, many cities forget one critical problem related to green spaces: gentrification. Gentrification occurs when new green spaces create an influx of new residents or tourists, leading to sociodemographic or housing cost fluctuations (Schinasi, 2021). When green spaces are introduced to a neighborhood, a phenomenon known as Green Gentrification occurs but if the government sets limitations on rent increase, invites community members to express their opinions when constructing green spaces, and implements a vacancy property tax, Green Gentrification may be prevented.

One critical aspect of Green Gentrification is the increase in property value and rent. When green spaces are implemented in underdeveloped areas, the overall well-being inevitably increases making the specific area more appealing. This attracts newcomers and allows for landlords to increase the value of their property (Jelks, 2021). For example, the Chelsea area of New York City used to be an undeveloped industrial area. However, as the construction of the High Line was completed, the area became a nationwide hotspot, causing homes adjacent to the High Line to increase in housing value by 35.3% (Black, 2020). In order to prevent the displacement of local residents, cities must implement a specific measure on rental limitations in areas where new green spaces are developed.

When constructing green spaces, it is rare that the local resident's voices are taken into account. The executive director of the New York High Line, Robert Hammond, claimed that they "had failed" in their initial intentions of creating the space for the community (Bliss, 2017). Policies, especially regarding environmental issues, are best handled with the direct participation of the concerned citizens. The implementation of citizens' desires will help green spaces by saving resources and creating a concrete result (Diressen, 2013). People are more likely to utilize and feel safe in an environment where their voices have been heard and implemented.

Implementing a vacancy property tax may be a solution in preventing gentrification by providing more affordable housing (Welborn, 2019). For example, Oakland, a heavily gentrified area, has forced their low-income black population out of the city, causing the black demographic to decrease by 25% and the median house price to increase by 178%. However, there are nearly 3000 vacant homes in Oakland alone (Williams, 2020). Implementing tax on such vacant properties might release more items into the rental market, thus settling the rental price.

As for citizen participation in green spaces, some might say that overwhelming amounts of public involvement can often lead to lengthy time consumption and financial cost. Also, if public participation is managed poorly, there might be potential backlash and hostility towards the government (Wouters, 2011). However, this does not relate to small-scale public participation regarding green spaces. In fact, civic participation keeps community life vital and it has been demonstrated that citizens are more than capable of addressing their knowledge in a feasible manner when it comes to public engagement (Roberts, 2004).

While creating green spaces is vital in helping a city become more environmentally sustainable, it is also important to be aware of the potential outcomes of gentrification. However, gentrification can be prevented if the city creates rental regulations, vacancy property tax, and

promotes active civic engagement. Rental regulations will prevent the displacement of current residents, vacancy property tax will maintain a stable real estate market, and active civic engagement will directly benefit the citizens along with fulfilling their needs.

## References

1. Melchiorri, M., Pesaresi, M., Florczyk, A. J., Corbane, C., & Kemper, T. (2019). Principles and Applications of the Global Human Settlement Layer as Baseline for the Land Use Efficiency Indicator—SDG 11.3.1. *ISPRS International Journal of Geo-information*, 8(2), 96. <https://doi.org/10.3390/ijgi8020096>
2. Schinasi, L. H., Cole, H., Hirsch, J. A., Hamra, G. B., Gullón, P., Bayer, F. J., Melly, S. J., Neckerman, K. M., Clougherty, J. E., & Lovasi, G. S. (2021b). Associations between Greenspace and Gentrification-Related Sociodemographic and Housing Cost Changes in Major Metropolitan Areas across the United States. *International Journal of Environmental Research and Public Health*, 18(6), 3315. <https://doi.org/10.3390/ijerph18063315>
3. Jelks, N. O., Jennings, V., & Gobster, P. H. (2021). Green Gentrification and Health: A Scoping Review. *International Journal of Environmental Research and Public Health*, 18(3), 907. <https://doi.org/10.3390/ijerph18030907>
4. Black, K. J., & Richards, M. (2020). Eco-gentrification and who benefits from urban green amenities: NYC's high Line. *Landscape and Urban Planning*, 204, 103900. <https://doi.org/10.1016/j.landurbplan.2020.103900>
5. Bliss, L. (2017, February 7). The High Line's Next Balancing Act. *Bloomberg.com*. <https://www.bloomberg.com/news/articles/2017-02-07/the-high-line-and-equity-in-adaptive-reuse>
6. Wouters, M. (2011). Evaluating public input in National Park Management Plan reviews Department of Conservation <https://www.doc.govt.nz/documents/science-and-technical/sfc308entire.pdf>
7. Roberts, N. C. (2004). Public Deliberation in an Age of Direct Citizen Participation. *The American Review of Public Administration*, 34(4), 315–353. <https://doi.org/10.1177/0275074004269288>
8. Williams, M. (2023, January 25). Gentrification doesn't have to force minority residents out of their homes. Activists say there are 3 ways to protect communities. *Business Insider*. <https://www.businessinsider.com/personal-finance/how-to-protect-longtime-residents-from-gentrification-2020-9>
9. Welborn, S. (n.d.). Vacancy Taxes: Pros and Cons. *DSNews*. <https://dsnews.com/featured/07-24-2019/vacancy-taxes-pros-and-cons#:~:text=Proponents%20of%20these%20vacancy%20taxes,profit%20when%20prices%20inevitably%20increas>

# Noise Pollution In Dhaka: Turning Down The Volume

Jialin Jiang, The High School Affiliated to Renmin University of China, Beijing, China

In Dhaka Bangladesh, one of the biggest contributors to environmental pollution is noise, much of which is needless. According to a survey on noise pollution by the United Nations Environment Programme (UNEP), the average noise frequency in Dhaka is 119 decibels in 2021, which is more than double the acceptable capacity (UNEP, 2021). People continually struggle with the annoyance and potentially severe health impacts of exposure to excessive noise because the noise levels in the city are significantly over those that have been determined to be acceptable for health and hearing. Monitored by the Department of Environment in Dhaka city, the main contributor to noise pollution is traffic noise, which can be reduced in the way of constructing noise barriers, a construction obscures noise, quiet pavement that lowers noise from pavement, and green borders, plants grown along the pavement that hinder sound transmission.

First of all, building noise barriers contributes to the reduction of sound propagation. Noise barriers, which are walls built along the side, obstruct the line of sight between vehicles and area inhabitants. In the use of noise barriers, the noise volume can be decreased by approximately nine decibels since it is blocked and absorbed during transmission. Recently, a new technology of the combination of wood-fiber-reinforced concrete and consolidated solid waste materials, carried out by Chalmers University of Technology (HOSANNA, 2013), was aimed to improve the existing technology of manufacturing noise-absorbing barriers from recycled materials. The new technological innovation is testified to increase sound absorption, improving the noise absorption capacity of conventional materials by 20-40%. The new kind of sound barriers by using sustainable materials can be a solution that is both efficient and environmentally-friendly for noise reduction.

Secondly, implementing quiet pavement is a strategy to mitigate noise from a sound source perspective. The idea behind quieter pavement is to lessen the effects that tire and pavement noise have on the surrounding environment of highways. The volume of traffic noise is affected by surface textures and bulk properties of the pavement. Based on these two attributes, two kinds of quiet pavement, porous-asphalt single-layer and porous-asphalt two-layer, are commonly used in Europe and the United States. Porous asphalt has been to lower noise by at least 5 dB over an average service life of 10-12 years. The porous two-layer pavement, on the other hand, is more technically complicated to manufacture although it has a better noise reduction effect of more than 6 decibels (Lodico, 2018). The average service life of the two-layer pavement is only about 3-10 years, which is very unstable compared to the former. In Bangladesh, asphalt pavement is being used in practically all new road construction (RRD, 2006). Like in all other nations, Bangladesh's lack of construction resources, rising costs along heavy material axes, unfavorable environmental conditions, and subpar construction methods have caused flexible pavements to fail, forcing engineers to think of more cost-effective and long-lasting pavement design methods and cutting-edge construction methods for building roads using native pavements (Hamim, 2017). Based on the traffic situation and economic condition in Bangladesh, the use of porous-asphalt single-layer is a desirable approach to reduce noise pollution.

The third suggested solution is building green borders that can cut decibels in the sound transmission process. Green borders are areas usually covered with trees, shrubs, and bushes.

According to the findings of Ow (2017), when vegetation was increased from a low to a moderate planting intensity, traffic noise was reduced by 50% (Ow and Ghosh, 2017). The ideal depth of green borders found to reduce the noise is about 5 meters. Due to land requirements, green borders are more suited to urban residential areas rather than highways. The benefits of green borders are not only noise reduction. It also has psychological and environmental benefits. Green borders' natural and attractive appearance relieves people's anxiety and thus reduces the noise of horns caused by road rage (Munira, 2017). At the same time, the psychological perception of people is that green borders reduce a lot of noise, which means that the noise reduction from the green barriers may be perceived as greater than the actual noise reduction. Besides, constructing green borders is a sustainable method to counteract air pollution caused by vehicle exhaust.

Undeniably, when renovating these transportation infrastructures, if implemented, they will also cause noise. The government should take into account the noise caused during renovations and the impact on the surrounding communities and residents. Nevertheless, I do believe that the long-term benefits of building this infrastructure far outweigh the inconvenience caused during construction. Construction of sound barriers, pavement and green borders usually takes several months to a year, but these facilities can be used for up to a decade or more (Ow, 2017). The government could give residents earplugs during construction, or move some neighborhoods temporarily away from the noise. Policies can also be put in place, such as only daytime work during the workday and no work on weekends.

There is an increasing popularity of infrastructure sustainability, defined as a development that satisfies existing requirements without jeopardizing the capacity of future generations to satisfy their own needs. By introducing the technology of sustainable sound barriers, quiet pavement and green borders, Dhaka city can not only meet the need of noise reduction, but also ensure residents to live in a quiet, peaceful and sustainable environment.

## References

1. RRD. (2006). Pavement Design Guide. Ministry of Communication, Roads and Railways Division..
2. HOSANNA. (2013). Novel solutions for quieter and greener cities.
3. Judith L.R. , Darlene, R., et al. (2016). Highway Traffic Noise. *Acoustic Today*,12(4), 38.
4. Lodico, D. M. (2018). Quieter Pavement: Acoustical Measurement and Performance (No. 18-04609).
5. Munira, S., & Santoso, D. S. (2017). Examining public perception over outcome indicators of sustainable urban transport in Dhaka city. *Case Studies on Transport Policy*, 5(2), 169–178.
6. Ow, L. F., & Ghosh, S. (2017b). Urban cities and road traffic noise: Reduction through vegetation. *Applied Acoustics*, 120, 15–20.
7. Praticò, F., Swanlund, Anfosso, F., & Dimitri, G. (2013). Quiet pavement technologies. ResearchGate.

# Soccer Field Innovation

Jinxi Yu, Jinling High School, Nanjing, China

Soccer is one of the most popular sports in the world, but soccer fields bring lots of problems to the urban environment. In 2021, there were about one hundred thousand soccer fields in China, and there were even more soccer fields in Europe and America (General Administration of Sport of China, 2022). Larger than a basketball or tennis court, a standard soccer field has a width of 68 meters and a length of 105 meters, which takes up a huge amount of urban area, about 345 million square meters in China (General Administration of Sport of China, 2022). Sometimes when there are no matches, and the soccer fields are idle, the efficiency of land use is very low. Moreover, the natural grasslands require plenty of water, about 23 tonnes of water for each soccer field per day (Watering a football pitch, 2022), and need a lot of labor to maintain, which is damaging to the sustainability of the city. If people can improve these soccer fields, cities with sustainability and equity can be established. By innovating soccer fields through policies to open soccer fields to the public, utilizing artificial turfs to reduce maintenance, and applying prefabricated construction, people can increase land use efficiency, save natural resources, and create soccer fields that are economic and environmentally friendly.

To begin with, by making new policies for the use of soccer fields, people can increase the efficiency of urban land use. Several years ago, due to the increasing popularity of soccer in China, more and more football fields were constructed. Every university, club, or official team has its own soccer fields, and some of them even have multiple soccer fields, which is unnecessary. As a result, there are lots of idle soccer fields, which is a waste of space. If the government can make policies that soccer fields should be open to the public for free for several days a week, these lands can be used more efficiently and effectively (Black, 1994). Moreover, people can gain new spaces for exercise or entertainment. Renting a football field costs about 800 yuan per hour in China, which is prohibitive. For those poor soccer lovers who cannot afford such a high rent fee, these new policies provide them with opportunities to do what they love, which can promote equity in the city.

In order to solve the problem of costly maintenance for natural grasslands on soccer fields, people can replace the natural grasslands with artificial turfs. The natural grasslands need to be watered every day in order to qualify for matches, thus costing a huge amount of natural resources. For example, each soccer field in Qatar, where the 2022 World Cup was held, needs about ten thousand liters of fresh water every day for irrigation in winter. Moreover, the natural grasslands require lots of labor work, such as mowing and repairing. Artificial turfs, on the other hand, need little maintenance after they are installed and are capable of high-intensity use in most weather conditions. The service life for artificial turf is about ten years. Furthermore, the artificial turfs are made from Polypropylene and Polyethylene and are filled with packing particles that can be made from waste tires (Schiliro, 2012). Therefore, they are less expensive than natural grasslands, which can significantly lower the cost of a soccer field and make it accessible to everyone. Admittedly, artificial turfs may influence the speed of the soccer ball and bring players more risks of getting hurt. However, that sacrifice is worthy since artificial turfs have a big advantage in resource sustainability.

Using prefabricated construction methods can help reduce pollution during construction and make the soccer fields more sustainable. To be more specific, the prefabricated construction method is that people produce separated components of a building in factories and then assemble them together at the building site (Li, 2014). Using prefabricated construction has lots of benefits. For instance, it creates much less construction waste, carbon dioxide emission, and noise to the

surrounding than using conventional construction methods, which can lead to cleaner and more environmental conditions (Navaratnam, 2019). Moreover, prefabricated construction is very time efficient and mainly depends on the use of machines, which can greatly reduce the work of laborers. What is more, the production components of buildings can be standardized, and some of these components can be reused after being dismantled. Undeniably, the cost of prefabricated construction is higher than conventional construction. However, if people can build soccer fields in this way, the damage to the environment can be minimized and the soccer fields will be biophilic and sustainable.

Some people may argue that making these innovations for soccer fields needs a lot of funding to start, and it can be a huge consumption of resources. For example, the publication of new policies will take up some governmental resources, and both the installation of artificial grass and the use of prefabricated construction needs money and time. However, in the long term, these payments can all bring rewards both financially and ecologically by requiring less maintenance and resource consumption (Schilirò, 2012).

In conclusion, by making innovations to soccer fields through revising site limitation policies, replacing natural grasslands with artificial turfs, and utilizing prefabricated construction, people can conserve natural resources and make soccer accessible to everyone, which can promote sustainability and equity and help develop green cities.

## References

1. Black, J. S., & Lloyd, M. G. (1994). Football Stadia Developments: Land-Use Policy and Planning Controls. *The Town Planning Review*, 65(1), 1–19.  
<http://www.jstor.org/stable/40113258>
2. General Administration of Sport of China. (2022). 2021 National Sports Venue Statistical Survey Data (2021年全国体育场地统计调查数据).  
<https://www.sport.gov.cn/jjs/n5043/c24251191/part/24251201.pdf>
3. Li, Z., Shen, G. Q., & Xue, X. (2014). Critical review of the research on the management of prefabricated construction. In *Habitat International* (Vol. 43, pp. 240–249). Elsevier BV.  
<https://doi.org/10.1016/j.habitatint.2014.04.001>
4. Navaratnam, S., Ngo, T., Gunawardena, T., & Henderson, D. (2019). Performance Review of Prefabricated Building Systems and Future Research in Australia. In *Buildings* (Vol. 9, Issue 2, p. 38). MDPI AG. <https://doi.org/10.3390/buildings9020038>
5. Schilirò, T., Traversi, D., Degan, R., Pignata, C., Alessandria, L., Scozia, D., Bono, R., & Gilli, G. (2012). Artificial Turf Football Fields: Environmental and Mutagenicity Assessment. In *Archives of Environmental Contamination and Toxicology* (Vol. 64, Issue 1, pp. 1–11). Springer Science and Business Media LLC. <https://doi.org/10.1007/s00244-012-9792-1>
6. Watering a football pitch. Access Irrigation. (2022, November 30).  
<https://www.access-irrigation.co.uk/guides-advice/watering-a-football-pitch/>



# More Green, Same Parking

Jongwhan Andrew Sung, Bergen County Technical High School, Teterboro, US

Urban heat islands (UHI) are a very big problem affecting cities all around the world. According to Deilami, Kamruzzaman, and Liu (2018), "UHI is a phenomenon when urban areas experience higher temperature compared to their surrounding non-urban areas" (p1). UHIs form when artificial materials such as asphalt and concrete absorb heat instead of reflecting it, causing temperatures to increase. This can cause quite a few problems for urban residents, such as higher energy consumption for cooling, increased pollution and greenhouse emissions, and environmental health risks (Deilami et al., 2018). A common solution to UHI is the reintroduction of natural vegetation. Infrastructure incorporating natural vegetation is a very attractive idea as it is a very effective tool to adapt to climate change (Razzaghmanesh et al., 2016). To mitigate UHIs, cities should turn some parking lots into parking buildings and turn the rest of the parking lot into green spaces.

The first benefit to converting some parking lots into parking buildings and converting the rest into green spaces is an obvious one: more green spaces. Green spaces are beneficial as they benefit general and mental health and decrease mortality (van den Berg et al., 2015). Many cities do not reach the recommended amount of 50 square meters of urban green spaces per capita (Russo and Cirella, 2018). By making green spaces all over a city, these beneficial areas become open to everybody, not just people in one area. Although making parking lots into parking buildings can make some areas of the city feel more closed off, more areas will become open green spaces. Furthermore, the parking buildings offer the opportunity to feature green spaces on their roofs.

Another benefit to this idea is that it makes the city more sustainable and eco-friendly. Solar panels can be installed on the roof of the parking buildings, making it energy efficient. Green roofs are very sustainable and energy efficient as they can keep buildings cool in the summer and insulate during the winter (Razzaghmanesh et al., 2016). To promote the use of electric vehicles, charging stations can be installed into the buildings, which can even be powered by solar panels. With parking spaces more spread out throughout the city, people will need an alternative form of transportation. People could walk or the parking buildings can have a station to rent out bikes. Either way, there will be less carbon monoxide emissions and healthier forms of transportation.

A third reason to convert parking lots to parking buildings is that it would stimulate the economy. Building the buildings and converting lots will need quite a bit of construction. This provides jobs for many people temporarily. Then, people will need to be hired to maintain the buildings and green spaces, creating permanent jobs. As mentioned before, charging ports and a bike rental system can also be implemented. These can be charged to be used, becoming a source of revenue for the city. Also, by mitigating the urban heat island effect, energy efficiency will go up, reducing operating costs. A potential limitation of these solutions is that they are likely to require considerable financial and time investment. Even more will be used to turn them into buildings and green spaces. The buildings will need to have a lot of infrastructure to accommodate many features such as solar panels, green roofs, and charging stations. It would also cost money to buy the bikes needed to set up bike rentals and implement a working system. The green spaces will need a lot of work as well, bringing in soil, plants, and a workforce to design and implement them. However, this solution will bring enough benefits to counteract the problem. Not only will the idea be able to pay for itself, it will also stimulate the economy, cycling the money spent back into the city.

The idea of converting parking lots into parking buildings and green spaces offers many benefits. This will keep the same amount of parking but also provide more space in the city. The spaces

made will be public areas all citizens can enjoy and benefit from. By converting parking lots into parking buildings and green spaces, the city becomes sustainable and eco-friendly while also promoting healthier lifestyles.

## References

1. Environmental Protection Agency. (n.d.). EPA.  
<https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect#:~:text=%22Urban%20heat%20islands%22%20occur%20when,heat%2Drelated%20illness%20and%20mortality.>
2. RIZWAN, A. M., DENNIS, L. Y. C., & LIU, C. (2008). A review on the generation, determination and mitigation of Urban Heat Island. *Journal of Environmental Sciences*, 20(1), 120–128.  
[https://doi.org/10.1016/s1001-0742\(08\)60019-4](https://doi.org/10.1016/s1001-0742(08)60019-4)
3. Razzaghamanesh, M., Beecham, S., & Salemi, T. (2016). The role of green roofs in mitigating urban heat island effects in the metropolitan area of Adelaide, South Australia. *Urban Forestry & Urban Greening*, 15, 89–102. <https://doi.org/10.1016/j.ufug.2015.11.013>
4. Deilami, K., Kamruzzaman, Md., & Liu, Y. (2018). Urban Heat Island Effect: A systematic review of spatio-temporal factors, data, methods, and mitigation measures. *International Journal of Applied Earth Observation and Geoinformation*, 67, 30–42.  
<https://doi.org/10.1016/j.jag.2017.12.009>
5. van den Berg, M., Wendel-Vos, W., van Poppel, M., Kemper, H., van Mechelen, W., & Maas, J. (2015). Health benefits of green spaces in the living environment: A systematic review of *Epidemiological Studies*. *Urban Forestry & Urban Greening*, 14(4), 806–816.  
<https://doi.org/10.1016/j.ufug.2015.07.008>
6. Russo, A., & Cirella, G. (2018). Modern compact cities: How much greenery do we need? *International Journal of Environmental Research and Public Health*, 15(10), 2180.  
<https://doi.org/10.3390/ijerph15102180>

# Problems With Shanghai's Pocket Park Construction Project

Junwen Xie, Shanghai Weiyv International High School, Shanghai, China

The Shanghai government increasingly has more ability to plan welfare projects in order to improve citizens' living quality and garner public support. The Minxin (People's Heart) Project was proposed years ago for improving infrastructure in rural areas but recently revised into a schedule for improving infrastructure and social services in cities. Individual project details were designed so as to meet the needs of local conditions. However, there have always been reports of public dissatisfaction towards the Minxin project including accusations of unscientific planning. Among various features of such a project, public satisfaction is particularly low with the construction of pocket parks, which are urban green areas with entertainment facilities (Duan, 2022). This paper investigates the decision-making process and result of pocket park projects and aims to discover the problems leading to resident dissatisfaction. To better actualize residents' ideas about pocket parks, the government should focus on strengthening autonomy of social organizations and enhancing congressional role in opinion-gathering and decision-making.

The main cause of the reported dissatisfaction is the lack of civil participation and civic awareness in Shanghai. The party's policies care about civil participation during the decision-making process of the Minxin project. Policies and changes were made to ensure the transition from 'Government decides, government applies' mode to 'People advise, congress approves, government applies, congress monitors' mode (Hu, 2022). However, any civil participation that goes beyond suggesting construction plans and details is being awarded, bottom-up civil participation turns into directorial opinion-giving meetings in which participants are chosen by the congress rather than participating spontaneously. District People's Congress has given out 2000 questionnaires to community staff, local residents, office workers and manual labor' (Shanghai People's Congress News, 2021). The policies are hindering people from bringing forward their ideas and the problems they face, so the results of building 'pocket parks' can't be satisfying to residents. From my point of view the congress should allow people to express their opinions about city planning freely and gather these opinions.

The lack of equity and accessibility awareness among the entire society and within the government negatively affects park planning and operating. Many parks set up fences that restrict people from entering freely, this leads to the decrease in civil participation in park facilities since they cannot enter the park easily. Moreover, fenced parks are gradually becoming gentrified and commercialized by the emergence of charged sport services and buffets. The government wants to provide green space for citizens and offer business opportunities to boost the economy simultaneously. Such a decision challenges the initial purpose of pocket parks, making them more of a commercial zone that cannot hold community activities or places full of low accessibility sport clubs (Smith, 2017). The government ought to restrict commercial and charged activities in these parks, especially when these activities occupy much resource and space and affect the accessibility and equity of parks.

Population problems are blocking people's enjoyment in pocket parks. Shanghai is a densely populated city with about 20 million residents. It was estimated that the average acreage of parks per capita in Shanghai is 8.8 square meters (Chinanews.com, 2022). Finite space means the irreconcilable conflict between people of different groups: different gender, age, hierarchy,

habits...Increasing the number of pocket parks would be a heavy burden to local budgets, while the few parks cannot satisfy the increasing needs of the newly emerged urban middle class. The government is unable to completely eliminate the unbalanced development of economy-equity-ecology nexus (Agyemen, 2003), only through negotiation between different groups of people can the problem be solved. From a realistic point of view, the action the government can do now is to publish bills that initiate friendly interaction between different people in parks.

There exists a common argument that pocket parks and other greenfields should clarify facility usage, preventing people from making use of the facilities in various ways and cause conflict. However, there are some problems with this idea, the first one is that restricting facility usage limits the accessibility of entertainment devices, hindering the construction of a society of equity. The second problem is that this may decrease the number of visitors to pocket parks (Gehl, 2010), and such exclusion cannot build up a lively city that promotes sustainable development.

In conclusion, at present the Shanghai government cannot completely assimilate residents' dissatisfaction towards pocket park projects because of the city's overpopulated condition and relatively low budget. However, the government can make some improvements in raising public awareness, promoting opinion exchange and civic participation as well as restricting commercialization, gentrification in pocket parks. After implementing these methods, city planners would be able to learn about the demands of local residents, realize their ideas and satisfy them. Commercial activities would be restricted and every pocket park would have high accessibility, improving equity in Shanghai.

## References

1. Duan Wenjie.(2022). Evaluation system and promotion mechanism of the construction of 'people's heart' project in Shanghai.109.
2. Hu Xiao.(2022). Implementing 'REAL' monitoring right, enhancing the welfare within 'Minxing Project'.42-43.
3. Shanghai People's Congress.(2021). Implementing 'Overall process people's democracy' to promote 'Minxing project' construction.
4. A.Smith.(2017).Animation or denigration? Using urban public spaces as event venues.609.
5. Chinanews net.(2022). Shanghai: Public green space per capita reaches 8.8 square meters, green pathway increases 200 miles annually.
6. J.Agyemen,T.Evans.(2003).Towards just sustainability in urban communities: building equity rights with sustainable solutions.36-38.
7. J.Gehl.(2010).Cities for people.68-73.

# How Mangroves Can Mitigate Jakarta's Sinking Problem

Karina Gunawan, North London Collegiate School, Singapore, Singapore

With the increasing influence of climate change and rapid urbanization across the globe, cities have been more prone to sinking than ever before. From New York City to Ho Chi Minh, densely populated cities are at risk of falling below sea level. The fastest sinking city in the world - Jakarta, Indonesia - is sinking at a rate of 10cm every year (Ng and Rivai, 2020). With a population of over 30 million, 40% of the land is already below sea level (Owen-Burge, 2022) because of land subsidence and rising sea levels. Due to colonialism and poor environmental regulations, many residents living near the coast of North Jakarta not only live in informal settlements (kampung) and rely on fishing for income, but are the most affected by the city sinking (Betteridge and Webber, 2019). The government has already proposed solutions to reduce the impacts of sinking – building a seawall and artificial islands – but are unsuccessful and inequitable (Garschagen, Surtiari and Harb, 2018). If man-made solutions have been ineffective in solving man-made problems, natural solutions might be able to instead. The restoration of mangroves on Jakarta's coast will reduce the impacts of rising sea levels, a major contributor to the city's sinking problem, by attenuating waves and keeping up with rising sea levels (Spalding et al., 2014).

Mangroves' ability to attenuate waves reduces the severity of rising sea levels and reduces risks for communities who live near the coast. Some mangroves have pneumatophores, root structures that help supply air necessary for root respiration (Britannica), that "strengthens their durability against wind" and result in wave attenuation (Kawata, 2022). North Jakarta has the highest percentage of Jakarta's poor population (5.35%) who live in illegal and vulnerable kampung, and those who live near the coast are primarily fishermen (Kawata, 2022). They can benefit from the restoration of mangroves as mangroves provide habitats for many commercial fish and improve water quality, benefitting both the environment and local economy. By attenuating waves, the mangroves' will reduce the severity of them and coastal erosion to make it safer for communities living near the coast.

In addition, mangroves are able to keep up with rising sea levels by increasing soil levels. Mangrove roots trap sediment and their own organic matter, so they build up overtime and produce "deep peaty soil" which increases in depth over time (Spalding et al., 2014), letting them keep up with sea levels. The accumulation of the sediment is able to preserve and expand coastlines, which would otherwise erode over time. To combat rising sea levels, the government proposed to build a sea wall and artificial islands near the north coast, though these solutions have been proven unsuccessful, thus incomplete and ultimately abandoned. Not only is moving to another island inequitable for the majority of Jakarta's population, but erosion would constantly undercut the sea wall and rising sea levels will undermine these artificial structures. Unlike the sea wall which would require constant repair, mangroves are able to keep up with sea levels naturally with low maintenance, justifying the importance of rehabilitating mangrove forests.

Although restoring mangroves on Jakarta's coast would significantly reduce the impacts of rising sea levels, if implemented too late, it might be impossible for the mangroves to adapt and would be ineffective. Lack of reinforcement might also lead to deforestation of mangroves by residents uneducated on the benefits of mangroves. Plastic pollution, poor water quality and land subsidence are prevalent problems in Jakarta, and counteract mangrove development (Spalding et al., 2014).

Nevertheless, the rehabilitation of mangrove forests is extremely beneficial for Jakarta's environment and communities most vulnerable to sinking.

Ultimately, the rehabilitation of mangroves on Jakarta's coast will reduce the impacts of rising sea levels exponentially and mitigate a major contributor to the city's sinking. With government reinforcement, the right management and educated citizens, mangrove forests will keep Jakarta's coastal communities safe and significantly reduce the severity of rising sea levels. Mangrove restoration highlights the importance of nature conservation in urban sustainability and resilience, and shows how urban cities, like Jakarta, need to utilize natural solutions for man-made problems.

## References

1. Betteridge, B., & Webber, S. (2019). Everyday resilience, reworking, and resistance in North Jakarta's kampungs. *Environment and Planning E: Nature and Space*, 2(4), 944-966.
2. Garschagen, M., Surtiari, G. A. K., & Harb, M. (2018). Is Jakarta's new flood risk reduction strategy transformational?. *Sustainability*, 10(8), 2934.
3. Gilmartin, L. M. (2019). *Jakarta Underwater: Rising Seas as Opportunity* (Doctoral dissertation).
4. Kawata, Y. (2022). Green Infrastructures in Megacity Jakarta: Current Status and Possibilities of Mangroves for Flood Damage Mitigation. In *Green Infrastructure and Climate Change Adaptation: Function, Implementation and Governance* (pp. 335-351). Singapore: Springer Nature Singapore.
5. Ng, D., & Rivai, I. (2020, February 28). Why Jakarta is the fastest sinking city in the world. CNA.  
<https://www.channelnewsasia.com/cnainsider/why-jakarta-is-world-fastest-sinking-city-floods-climate-change-781491>
6. Owen-Burge, C. (2022, August 22). Jakarta: The sinking city. *Climate Champions*.  
<https://climatechampions.unfccc.int/jakarta-the-sinking-city/>
7. Spalding, M., McIvor, A., Tonneijck, F. H., Tol, S., & Van Eijk, P. (2014). Mangroves for coastal defence. *Guidelines for coastal managers & policy makers*. Wetlands International and the nature conservancy, 42.
8. Tree - Structure and function | Britannica. (n.d.). [Www.britannica.com](https://www.britannica.com/plant/tree/Tree-bark#ref368831).  
<https://www.britannica.com/plant/tree/Tree-bark#ref368831>
9. UNEP. (2023, February 2). Mangrove restoration gives hope to Indonesia's sinking shores. UNEP.  
<https://www.unep.org/news-and-stories/story/mangrove-restoration-gives-hope-indonesias-sinking-shores>

# Enhancing Equity In Green City Planning

Kitty Zhang, Northfield Mount Hermon, Gill, USA

With rising pollution and population in recent years, there has been a growing focus on urban green city planning initiatives to establish environmentally friendly and sustainable environments. These initiatives include the construction of urban green spaces (UGS), which include parks, community gardens, and other vegetated areas that not only mitigate the impacts of natural disasters and reduce pollution but also enhance the overall well-being of residents and biodiversity (Muqueeth, 2021). However, due to policies (such as redlining) and economic inequalities, immigrants and/or poor individuals frequently receive unequal benefits from UGS (Huang et al., 2023). For instance, in 2020, US parks located in communities where the majority of residents are people of color tend to be approximately half as big but serve nearly five times as many people per acre compared to parks serving predominantly white populations (Muqueeth, 2021). In 2021, predominantly people of color neighborhoods face a 44 percent lower availability of park acreage compared to predominantly white neighborhoods, and low-income neighborhoods have an average of 42 percent less park acreage per person compared to high-income neighborhoods in the US (Parks and an Equitable, 2021). Most importantly, communities with predominantly people of color were found to have a three times higher likelihood of residing in areas with limited access to nature compared to white populations (Parks and an Equitable, 2021). These disparities highlight the pressing need for affirmative action in green space planning to ensure equitable access. The construction of additional parks and open green spaces, such as Anacostia Park in Washington, D.C., is essential for advancing social justice and alleviating the inequalities experienced by marginalized communities in urban areas, as these spaces offer equitable recreation opportunities, enhance public health and well-being, and encourage community involvement, ultimately leading to more equitable green city planning.

Low-income communities are often disproportionately exposed to higher levels of air pollution, extreme heat, and increased vulnerability to natural disasters compared to their affluent counterparts (Muqueeth, 2021). UGS have the potential to address these issues and promote equity through various benefits. These include the prevention of flooding through soil infiltration, improving air quality by absorbing pollutants and releasing oxygen, mitigating the urban heat island effect by providing shade, creating habitats for wildlife, and reducing indoor electricity usage by encouraging outdoor activities (Eldridge et al., 2019). Additionally, UGS provides a wide range of recreational activities and programs that promote the physical and mental well-being of residents. Through activities such as yoga, health and wellness seminars, art and music classes, guided walks, and educational sessions, UGS can improve the overall health of residents, foster community cohesion, connect people with nature, and raise environmental awareness (Anacostia Park). By providing these resources, UGS allow everyone, especially those in lower-income neighborhoods, to enjoy the same recreational amenities as their counterparts in wealthier areas.

However, many people, especially current residents, might argue that with the construction of UGS in underprivileged areas, there will be green gentrification. To address this concern, green city planners in these areas should align with the goals outlined in the United Nations' Sustainable Development Goals, particularly goals 8 (Decent work and economic growth), 9 (Industry, innovation, and infrastructure), and 11 (Sustainable cities and communities). This alignment will ensure that future UGS are accessible to all marginalized groups, including women, people with disabilities, and immigrants, while preventing displacement and gentrification. For example, Goal 11 aims to provide residents with access to safe and inclusive green spaces, while also ensuring that everyone has



access to safe and affordable housing (Department of Economic and Social Affairs, 2023). Moreover, creating new housing policies and using funds from nonprofits (for example, Community Land Trusts and Tax Increment Financing) or national parks can be a valuable approach to protect communities from gentrification (Eldridge et al., 2019). One example is in California, where establishing equity criteria for funds raised in underserved neighborhoods helps prioritize projects that prevent resident displacement (Eldridge et al., 2019). Furthermore, concerns regarding clearing more land for park buildings can be alleviated by repurposing existing infrastructure and utilizing underutilized spaces to create UGS (Muqueeth, 2021). For example, closed-down shopping malls can be transformed into parks, and schoolyards can be converted into community gardens. Many restoration projects like these have already taken place. The High Line Park in the US, for instance, has transformed a freight rail line into a public park. Similarly, the Cheonggyecheon Stream in South Korea is an urban renewal project that removed an old elevated highway and restored it as a stream and park. Moreover, by engaging in volunteer work or school-based initiatives, communities can help with maintenance!

Urban green spaces play a critical role in creating equity in urban city planning. By providing equal access to recreational areas, improving public health and well-being, and fostering community engagement, these spaces promote and contribute to a more equitable urban environment and help mitigate climate change in more areas. By aligning with the UN's goals, employing innovative funding approaches, and involving the community, issues such as gentrification can be prevented. As cities continue to expand, prioritizing the inclusion of abundant parks and open green spaces in urban planning will be key to ensuring that all residents can enjoy the benefits of a sustainable urban landscape.

## References

1. Anacostia Park. (n.d.). Our Programs. Friends of Anacostia Park.  
<https://www.friendsofanacostiapark.org/park-residencies>
2. Department of Economic and Social Affairs. (2023). Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable. United Nations.  
<https://sdgs.un.org/goals/goal11>
3. Eldridge, M., Burrowes, K., & Spauster, P. (2019, July). Investing in Equitable Urban Park Systems: Emerging Funding Strategies and Tools.
4. Huang, B.-X., Li, W.-Y., Ma, W.-J., & Xiao, H. (2023). Space accessibility and equity of urban green space. *Land*, 12(4), 766. <https://doi.org/10.3390/land12040766>
5. Muqueeth, S. (2021). Parks: A vital community condition. *Parks Stewardship Forum*, 37(1).  
<https://doi.org/10.5070/p537151742>
6. Parks and an Equitable Recovery. (2021, May 27). Trust for Public Land.  
<https://www.tpl.org/parks-and-an-equitable-recovery-parkscore-report>

# After School Climate Assemblies

Nivedha Goli, The Altamont School, Hoover, U.S.A

For years, marginalized groups have been on the frontlines of the climate crisis, yet according to Bouyé & Waskow (2021), “they also often benefit least from climate actions and bear the brunt of social costs”. So despite this lack of representation, how is it possible to truly fix these environmental problems in urban areas? Creating resilience is necessary which means knowledge acquired through education is needed. Yet if these minority communities do not have access to climate education and action, there is a clear lack of equity. Then the question of sustainability in these urban areas must be raised; for there to truly be urban sustainability, the entire community must be involved. For minorities to gain access to a platform where they can be heard and to proper climate resources, public schools need to invite local climate activists to help them rebuild their curriculum and be used as meeting hubs for community climate assemblies.

Though proper education is necessary to fight climate change, Cho (2023) finds that communities of color that live in poorer districts, these groups being the most susceptible to the impacts of the climate crisis, often lack the resources to implement these programs in school. To tackle this problem, the establishment of cost-free climate change curricula in schools is necessary, but there need not be identical syllabi for these courses at every public school. Standardized education programs often do not have the ability to focus on issues at a community level, so rather than having children learn only about issues across the ocean, local activists should be involved in educating and shaping these young minds. Representatives of educational institutions could contact activists through social media or find local activist groups and reach out. However, it is dangerous to assume that every locality has activists that are reachable, so schools could also contact local environmental organizations. These actions will be able to transform a public school’s curriculum, give these children proper education and resources to combat climate change, and inspire them to create change in their community.

However, the burden should not only be on today’s youth; instead, the entire community should help combat environmental issues and can do so through community climate assemblies. Gatherings could be led by anyone and would value polycentric governance when making decisions. Local activists could use meetings to raise awareness about what they are doing and this can cause their actions to gain traction. These meetings will allow regular citizens to be involved in climate action and will be a place of learning for everyone, while also providing a platform for those who are often cast away when it comes to battling environmental issues. Defined by Bächtiger (et al., 2018, p. 2), climate assemblies are smaller forms of deliberative democracy, system that are “grounded in an ideal in which people come together, based on the equal status and mutual respect, to discuss the political issues they face, and based on those discussions, decide on policies that will affect their lives.” These meetings that exonerate this form of democracy allow marginalized people to share their experiences and opinions and finally be listened to. Though climate assemblies already exist the uniqueness of the proposed solution would be its location.

Unfortunately for minority groups Vietinghoff’s study (2021) shows that, “racism, financial precarity, a lack of accessible information about services, and spatial inequalities” prevent many from fighting against or accessing information about the climate crisis. Acknowledging this, if zoned public schools are used as hubs for climate meetings this allows residents to be able to access a meeting in their zone, and since public transportation already exists to go to schools the concern of travel will not

be a major one. However, this does not mean that all issues when implementing this plan for climate education and schools as environmental meeting hubs are eradicated.

There are several barriers that could hinder this solution and thus result in its failure. The ultimate concern according to Willis, Currato, and Smith (2022) when it comes to climate assemblies and education is the fact that it is simply not strong enough and will not lead to truly progressive change. Although these actions may lead to awareness, if nothing else is done citizens may lose interest and participation might be lost. Despite the fact that these solutions will still have benefits even if these barriers appear, it is important to keep in mind these issues before implementing these solutions.

Overall this solution will raise awareness and encourage people to get involved in the fight against climate change and its effects. By educating youth and the community the promise of creating a sustainable city will be put in place. Climate assemblies will be a place where everyone's voice is heard and will tackle the silence placed on marginalized communities. Diversity is needed in order to improve the future of this planet and implementing local solutions will allow marginalized communities to gain access to resources and a platform for their voices.

## References

1. Cho, R. (2023, February 17). Climate education in the U.S.: Where it stands, and why it matters. State of the Planet. <https://news.climate.columbia.edu/2023/02/09/climate-education-in-the-u-s-where-it-stands-and-why-it-matters/>
2. Bouyé, M., & Waskow, D. (2021, November 11). Climate action isn't reaching the most vulnerable - but it could. World Resources Institute. <https://www.wri.org/insights/how-climate-action-can-help-vulnerable-populations>
3. Bächtiger, A., Dryzek, J. S., Mansbridge, J., & Warren, M. (2018). The Oxford handbook of deliberative democracy. Oxford University Press.
4. Vietinghoff, C. (2021, February 13). An intersectional analysis of barriers to cycling for marginalized communities in a cycling-friendly French city. *Journal of Transport Geography*. <https://www.sciencedirect.com/science/article/abs/pii/S096669232100020X>
5. Willis, R., Curato, N., & Smith, G. (2022). Deliberative democracy and the climate crisis. *Wiley Interdisciplinary Reviews: Climate Change*, 13( 2), e759. <https://doi.org/10.1002/wcc.759>

# A New View of Death

Sabrina Lewis

The efficiency of limited space in urban living areas must be optimized. As green spaces are used in cities to combat heat islands and connect people to nature, their potential cannot be reduced to the color of the land. In particular, graveyards are considered green spaces (Gómez-Baggethun, 2013), but save for their high Albedo advantage, they harm the environment. In cities, the compact nature of graveyards beside living spaces turns malpractices into more potent issues. Not only do harmful lawn practices contribute to more significant environmental issues and contaminate nearby water sources (Leopord, 2022), but embalment and casket preservative practices act as additional pollutants (Harker, 2012). Psychologically speaking, funeral practices damage emotional compliance with green city principles because they bar the deceased from aiding the creation of more life. Natural burials are a solution that minimizes harmful environmental impacts and maximizes death's environmental benefits (Conserve, 2019). Since cemeteries count as green spaces, it is crucial to maximize their benefit instead of letting their current state satisfy environmental requirements. Cemeteries can only reach their fullest green city benefit potential as a thriving ecosystem of natural burials.

Short-cut lawns in cemeteries are a detrimental custom disguised as an aesthetic – fixable by natural burials. The twentieth-century introduction of the lawn came about for its 'clean' presentation and economic feasibility related to the introduction of the lawnmower (Rugg, 2006). Shortly after, the damaging nature of such a practice became apparent. When grass is cut short, the leaf cannot absorb as much energy from the sun. Combined with a lack of diversity (causing single species to deplete the area of their specifically needed nutrients), this shortness drains the grass of its vibrant color. To compensate for the decoloration, groundskeepers apply fertilizers and often pesticides due to the lack of biodiversity. The roots of these plants reduce along with their leaf size and therefore are less able to hold soil or water in place. When it rains, the ground can no longer avoid copious amounts of runoff, causing nearby water sources to fill with pesticides and fertilizer. Excess fertilizer causes algal blooms leading to hypoxic water and loss of the resource (Kamienski, 2021). With natural burials, there are enough natural resources from decomposition to foster a vibrant, diverse ecosystem. The harmful effects of current practices go beyond the results of lawn care.

The customary process of preserving a body to put it in an equally toxically preserved coffin harms the environment and people, necessitating a more natural operation. Embalmers face approximately eight times higher risk of contracting blood diseases like leukemia (Hauptmann et al., 2009), and groundskeepers are more likely to develop COPD, cancer, and neurological diseases due to routine chemical exposure (Webster, 2016). The toxicity of these practices is unnecessary and restricts the natural circle of life that promotes sustainability on Earth. Standard funeral practices also demand permanent non-biodegradable vaults and caskets. Each year the US uses over 1.6 million tons of reinforced concrete, along with imported steel and exotic woods, which leads to significant carbon emissions (Webster, 2016). Increasingly common biodegradable alternatives like mushroom-based coffins are a core element of natural burials. The availability and efficiency of compounds such as Mycelium hyphae create a more affordable and sustainable alternative (Asore, 2021). Another humanitarian aspect of natural burials is the psychological impact.

Natural burials could aid the psychological shift needed to embrace the principles of green cities. Humanity is obsessed with preservation, and its fear of change prevents the integration of natural processes and human favor (Cone, 2023). With a natural burial, dead human matter contributes to the beautiful forest of biodiversity. The normalization of life created from death creates

comfort and a larger connection to nature. Natural burials offer a way to destigmatize death and provide society comfort surrounding such a traumatic subject. The growth of said process is likely to benefit from its alignment with broader societal trends, as people's increasing comfort with its goals can enhance its appeal (Hess, 2022). Such a simple transition would develop the human connection to nature through their family – better than a simple urn.

A common misconception is that cremation could solve the issues found in these practices, but natural burials are the far more sustainable solution. Cremation produces a wide range of dangerous air pollutants, such as particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds, and heavy metals – deeming it a harmful procedure (Xue et al., 2018). Though cremation is common, replacing it with natural burials is severely beneficial.

The optimization of graveyards is crucial to maximizing the benefits of green spaces in urban areas so that harmful practices do not undermine them. Green and short lawns, harmful preservative practices, and psychological barriers go against everything that green cities stand for. Natural burials present a solution that minimizes environmental impacts and maximizes the environmental benefits of death. It is essential to maximize the potential of cemeteries as thriving ecosystems of natural burials to realize their optimal benefits.

## References

1. Leopold Sibomana Leonard; Assessment of groundwater quality along cemeteries and associated potential health concerns in Dar es Salaam, Tanzania. *Water Practice and Technology* 1 May 2022; 17 (5): 1218–1229. doi: <https://doi.org/10.2166/wpt.2022.041>
2. Harker, A. (2012). *Landscapes of the Dead: An Argument for Conservation Burial*. Berkeley Planning Journal, 25(1). <http://dx.doi.org/10.5070/BP325111923> Retrieved from <https://escholarship.org/uc/item/7br0d6c3>
3. Rugg, J. (2006). Lawn cemeteries: The emergence of a new landscape of death. *Urban History*, 33(2), 213–233. doi:10.1017/S0963926806003786
4. Hauptmann, M., Stewart, P.A., et al. (2009). Mortality from lymphohematopoietic malignancies and brain cancer among embalmers. *J Natl Cancer Inst*, 101(24), 1696-1708. doi: 10.1093/jnci/djp416. PMID: 19933446; PMCID: PMC2794303.
5. Webster, L. (2016). Changing landscapes. Retrieved from [https://www.greenburialcouncil.org/opening\\_closing\\_maintenance\\_green\\_burial\\_grave.html](https://www.greenburialcouncil.org/opening_closing_maintenance_green_burial_grave.html)
6. Asore, E. P. (2021). Green packaging: Mushroom-based packaging for sustainable development in Nigeria. *International Journal of M S and E*, 21(7), 272. ISSN-1994-0386 (Print).
7. Xue Y, Cheng L, Chen X, et al. Emission characteristics of harmful air pollutants from cremators in Beijing, China. *PLoS One*. 2018 May 2;13(5):e0194226. doi: 10.1371/journal.pone.0194226. PMID: 29718907; PMCID: PMC5931459.

# Usable Waste

Samantha Liu, Oak Ridge High School, El Dorado Hills, United States

Every year, the world generates around 4 billion metric tonnes of waste (Nizar et al., 2018). Waste has become so normalized that we barely notice it on the streets. The steady increase in waste generation is problematic due to the cost of collecting the waste and the environmental issues created by landfills (Esmaeilian et al., 2018). Various communities have encouraged recycling, community garage sales, and private-run thrift stores as avenues for waste diversion. However, the success of the thrift store as a business has forced prices to go up (Machado, 2019), slowly eroding equitable access. We need a better solution. The community Free Surplus Facility is a warehouse, funded by a private or public partnership, where people donate their unwanted items, and other people would pick up these items for free. Think of it as a thrift store where everything costs \$0. The community Free Surplus Facility would help make a city more sustainable and equitable by diverting waste from landfill, allowing all citizens to freely benefit from each other's surplus goods, and creating more community connections.

Finding a new home for usable waste, the facility will help lessen the amount of items ending up in landfills. People often think of unwanted items as all useless junk, but that is a misconception. Approximately 20% of what we throw away can be recycled or refurbished (Nizar et al., 2018). Creating a way for the city to close the loop with consumption would greatly help reduce waste (Nizar et al., 2018; Geissdoerfer et al., 2017). People are often less critical of items they get for free, and they are more willing to spend more time in search for those free items (Shampanier et al., 2007). Therefore, a community Free Surplus Facility would increase the amount of donated items that people bring home, which would lead to an increase of waste diverted from landfills. Additionally, the facility can also host events or projects related to restoration, upcycling, and general environmental education. The "free" and educational aspects of this facility would help create a closed market and plant the seeds for more conscientious consumption.

A facility with free items will make all surplus items accessible to anyone at any different income levels. The increased popularity of thrift stores (Darley, 1999) has triggered a substantial increase in prices (Machado, 2019), making them less accessible. When people think of thrift stores, they think of cheap, affordable prices. However, it is not shocking to see thrift stores scale up a jacket to \$66 instead (Machado, 2019). Those who relied on buying goods from the thrift store are being priced out. The community Free Surplus Facility would create a place that is accessible to all since "customers" would not have to worry about prices at all. They could then get necessary items for their home without the extra stress on financials, and it would create a more equitable place to get surplus household items.

Furthermore, by creating a niche, unique place, community members could meet similar, like-minded members to create new friendships with. People could come together to share a common experience of learning to repair or restore items or to build care packages for disaster victims. To build a resilient community, social connections within the community and a sense of belonging are crucial (Berkes, 2013). This environment in the facility would be unique because it is a one-stop shop for picking items up and also restoring them. People could meet similar people and share the experience of repairing. More connections would be created since people are often drawn to like-minded people (Block, 2018). It is a place where people can come and restore an item to bring to their home, or they could bring an item from home to restore. While they do that, they could connect with one another, creating friendships to last.

However, some may argue that this facility would take business away from other organizations or thrift stores because people would rather pick up free items than purchase. Most thrift stores, like Goodwill, only want gently used items (Acceptable donations, n.d.). Although the facility may take some business away from other organizations, it would mainly appeal to a different audience. Since it would have all usable items, perfect or not, for free, the facility would attract a less particular and more diverse audience. In addition, many people could enjoy the process of fixing old pieces and making them new again at the facility, which would foster community instead of being purely a retail store. It also gives the more worn in items a place besides the trash, and other organizations could continue collecting gently used items, as usual, with their customers, who want an easy, quick alternative to new.

Because the community Free Surplus Facility allows another outlet for waste, anyone to access, and more community connections, it would make the city more sustainable and equitable. Even if such a facility may not come to your city, advocate for one. Next time, when you have an item that you no longer find use of, think of some ways to repair or give it to someone in need.

## References

1. Acceptable donations. (n.d.). Goodwill NNE. Retrieved July 1, 2023, from <https://goodwillnne.org/donate/acceptable-donations/>
2. Berkes, F., & Ross, H. (2013). Community Resilience: Toward an Integrated Approach. *Society & Natural Resources*, 26(1), 5–20. doi:10.1080/08941920.2012.7366
3. Block, P. (2018). *Community : the structure of belonging*. Berrett-Koehler Publishers.
4. Darley, W. K., & Lim, J. (1999). Effects of store image and attitude toward secondhand stores on shopping frequency and distance traveled. *International Journal of Retail & Distribution Management*, 27(8), 311–318. doi:10.1108/09590559910288596
5. Esmailian, B., Wang, B., Lewis, K., Duarte, F., Ratti, C., & Behdad, S. (2018). The future of waste management in smart and sustainable cities: A review and concept paper. *Waste Management*, 81, 177–195. doi:10.1016/j.wasman.2018.09.0
6. Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. doi:10.1016/j.jclepro.2016.12.
7. Machado, M. A. D., Almeida, S. O. de, Bollick, L. C., & Bragagnolo, G. (2019). \*Second-hand fashion market: consumer role in circular economy. *Journal of Fashion Marketing and Management: An International Journal*, 23(3), 382–395.\* doi:10.1108/jfmm-07-2018-0099
8. Nizar, M., Munir, E., Munawar, E., & Irvan. (2018). Implementation of zero waste concept in waste management of Banda Aceh City. *Journal of Physics: Conference Series*, 1116, 052045. doi:10.1088/1742-6596/1116/5/052045
9. Shampanier, K., Mazar, N., & Ariely, D. (2007). Zero as a Special Price: The True Value of Free Products. *Marketing Science*, 26(6), 742–757. doi:10.1287/mksc.1060.0254



# Stewardship To Build Habitat Gardens

Yijie (Sarah) Li, Ulink College of Shanghai, Shanghai, China

Given the ongoing large-scale urbanization, native species and ecosystems face significant threats, while access to nature remains inequitable for citizens. To address these issues, habitat gardens are proposed. Considering the unique development models and high-density buildings in urban areas, habitat gardens are envisioned as relatively small multifunctional parks with native plants, maintained by the community (Kou et al., 2019). These gardens serve as vital habitats for native wildlife, while also offering scenic views, outdoor recreation, and community activities for locals. However, the lack of awareness of this concept makes it difficult for the community to initiate and maintain habitat gardens. Stewardship, actions taken by individuals to protect the environment in pursuit of socio-ecological outcomes, could be the solution. This article examines how stewardship can help to construct habitat gardens by enhancing environmental identity, environmental literacy, and social relations.

Stewardship in creating habitat gardens constructs environmental identity and forms a positive feedback loop. Environmental identity is a cognitive fix, defined as a sense of connection to the environment affecting our perception and action toward the world. Individuals with strong environmental identities will conduct relatively more pro-environmental behaviors. Place attachment, as one perspective of environmental identity, is significantly related to volunteer work in habitat restoration in urban parks, as Ryan (2005) found, which shows a positive association between the degree of environmental identity and the frequency of participation in stewardship. The cultivation of a habitat garden is an act of socio-ecological restoration, interactively forming individuals' strong place attachments in the process of modifying a site with habitat restoration. With a greater sense of emotional place attachment and environmental identity, civic engagement increases. This positive feedback loop supports a self-sustaining community empowered by strong environmental identities to grow native plants.

Participation in stewardship activities improves environmental literacy through education and empowerment. Stewardship, in formal training and informal discussions among participants (removing invasive species, planting natives, rejecting chemical fertilizers), teaches planning techniques and gardening technology. This low-threshold process can encourage more inexperienced people to join in and increase equity and inclusion in civic engagement. Meanwhile, awareness of environmental issues will be raised. Instead of traditional landscape management, the volunteers serving the habitat garden envision these places as returning to the appearance of untouched nature, rooted in concepts such as biodiversity and native ecosystems, whereas other park users could not realize these biophilic characteristics. Stewardship, therefore, proposes an action competence approach, intentionally targeting actions at solving the environmental problem of habitat restoration. Citizens will be making decisions and considering power relationships (Krasny et al., 2014).

Stewardship creates a cultural ecosystem with social connections and spillover of behavior changes. Involvement in stewardship communicates with people, develops shared beliefs and values, and goes beyond personal advantages to collective work (Krasny et al., 2013). The social interaction attracts participation while improving the quality of collaboration to develop habitat gardens. As the positive spillover effect illustrates, after civic participation, individuals seek to contribute in a broader range, which in turn contributes to more resilient communities. According to a 172-respondents survey in Portland area parks, half of the volunteers suggested they talk to their neighbors about restoration to raise awareness while sixty percent indicated interest in leadership positions (Dresner et al., 2015).

In the Herb Garden in Shanghai, stewardship helped to identify active and capable residents who could act as community leaders to mobilize others' participation in a garden building. The leaders train the residents and significantly accelerate the propagation of initiatives (Kou et al., 2019).

Despite the benefits of stewardship, some argue that the lack of trust challenges the effectiveness of plans. People are unwilling to take the time to steward and lack the trust to start building habitats together. Admittedly, the self-maintaining characteristic of a habitat garden makes it a demanding task for individuals. But currently, these projects are initiated by authoritative organizations and institutions, which are reliable and trustworthy locally. The initiative utilizes education and intergenerational recreation activities with the broader community, to foster social capital attributes, such as informal socializing and social trust (Krasny et al., 2015). The habitat garden has to be started by organizations and the capacity and confidence to self-maintain can be built with education and interaction.

Underuse of habitat gardens in urban areas would miss a potential chance to restore native habitat while improving community interactions, stewardship has to be utilized to construct more habitat gardens. The sense of place in environmental identity forms a positive feedback loop to motivate stewardship. The empowerment of environmental literacy allows actions to target the urban ecological problem. Despite the challenge of untrust, social connections, and leaders could guide the development of habitat gardens in the right direction.

## References

1. Bennett, N. J., Whitty, T. S., Finkbeiner, E., Pittman, J., Bassett, H., Gelcich, S., & Allison, E. H. (2018). Environmental stewardship: a conceptual review and analytical framework. *Environmental management*, 61, 597-614.
2. Dresner, M., Handelman, C., Braun, S., & Rollwagen-Bollens, G. (2015). Environmental identity, pro-environmental behaviors, and civic engagement of volunteer stewards in Portland area parks. *Environmental Education Research*, 21(7), 991-1010.
3. Kou, H., Zhang, S., & Liu, Y. (2019). Community-Engaged Research for the Promotion of Healthy Urban Environments: Case Study of Community Garden Initiative in Shanghai, China. *International Journal of Environmental Research and Public Health*, 16(21), 4145.
4. Krasny, M. E., Kalbacker, L., Stedman, R. C., & Russ, A. (2013). Measuring social capital among youth: applications in environmental education. *Environmental Education Research*, 21(1), 1-23.
5. Krasny, M. E., Russ, A., Tidball, K. G., & Elmqvist, T. (2014). Civic ecology practices: Participatory approaches to generating and measuring ecosystem services in cities. *Ecosystem Services*, 7, 177-186.
6. Krasny, M. E., Kalbacker, L., Stedman, R. C., & Russ, A. (2015). Measuring social capital among youth: applications in environmental education. *Environmental education research*, 21(1), 1-23.
7. Ryan, R. L. 2005. "Exploring the Effects of Environmental Experience on Attachment to Urban Natural Areas." *Environment and Behavior* 37 (1): 3-42.

# From Hotspots To Cool Havens

SeungJun Lee, Saint Johnsbury Academy Jeju, Jeju, South Korea

Summer in South Korea has always been hot. Particularly, summer in recent years in Seoul, the capital city, feels extraordinarily balmy and long. According to the National Institute of Meteorological Sciences of Korea, over the past 106 years, the average temperature has increased by 1.4 degrees celsius, and the summer has extended by 19 days. Seoul, where many buildings and infrastructure are condensed, is experiencing a noticeable increase compared to suburban areas due to the Urban Heat Island Effect, UHI. Furthermore, this temperature rise due to UHI increases the possibility of heat-related diseases or death (Basu and Samet, 2002). Consequently, in Seoul, where the city's safety and well-being must be guaranteed first, the Seoul Metropolitan Government has been forced to take the most effective but environmentally harmful short-term action: installing additional air conditioners ("Heat wave relief," 2023). However, the problem is that as the usage of air conditioners increases, the city's temperature ironically rises as well. Since air conditioners emit "heat-trapping greenhouse gases," more operations of AC to resist scorching weather will inevitably fall into a vicious cycle of growing temperatures again (UCAR, n.d.). This essay argues that vertical gardens can effectively mitigate the urban heat island effect (UHI) and the vicious cycles it creates, thereby fostering the development of sustainable, livable, and green cities.

Vertical gardens lower the heated urban environment's temperature through their natural cooling mechanism to solve the increased temperature in developed cities. Vertical gardens, also known as livable green walls, refers to placing plants on walls or the exterior walls of buildings rather than planting them on the ground (Ambius, n.d.). The installed plants absorb solar radiation and prevent it from being converted into heat, otherwise resulting in rising temperatures (Ksenzhek and Volkov, 1998, p.31). As a result, the "temperature of the external wall" would be naturally reduced (Nicolini et al., 2022, p.1). This means that we can reduce the UHI as soon as we construct buildings without using the space we lack on the ground to set up a garden. Likewise, "integrating vegetation into architecture" has "environmental and microclimatic" benefits within the city (Ivanova et al., 2020, p.3).

In addition to natural cooling properties, vertical gardens contribute to energy efficiency and reduce the demand for air conditioning. By acting as insulation for buildings, these green walls reduce the amount of heat transferred indoors and outdoors. Therefore, it is expected to reduce the cooling and heating load in summer and winter and help regulate indoor temperature (Go et al., 2022, p.635). A thermal transmittance experiment on public buildings in Gunsan, Jeollabuk-do, Korea, confirmed that the vertical garden system greatly improves the thermal performance of the building's exterior (Go et al., 2022, p.635). If less heat were transmitted in the building, people would be less likely to use air conditioning. This decreased reliance on air conditioners eventually leads to considerable energy savings and a subsequent cutback in greenhouse gas emissions, the culprit of UHI (UCAR, n.d.). Consequently, the UHI caused by heat confinement is anticipated to decrease slightly. While it may be challenging to suggest a solution that requires complete reform of the city structures or lowering building heights, vertical gardens present a practical and effective approach to reducing energy consumption and alleviating UHI.

Vertical gardens not only mitigate UHI but also play a significant role in advancing the biophilic city concept. Installation of the vertical garden will open the gate to a biophilic "city that puts nature first in its design, planning, and management" for people (Beatley, 2011, p.45). Cities improve aesthetics and promote residents' well-being by integrating vertical gardens into urban landscapes. A

single building with a vertical garden may have a small impact. However, if this trend continues and more biophilic design buildings and spaces are created, the overall quality of urban space will be improved. By accepting the biophilic city concept through vertical gardens, cities go through a transformative shift towards sustainable and livable environments where residents can enjoy and reconnect with nature.

However, critics may argue that large-scale implementation of vertical gardens is challenging due to high installation and maintenance costs. The initial expenses to install plants and irrigation systems to control watering and monitoring can be substantial. Also, it indeed takes lots of time and money to maintain plants on the exterior of buildings for a long period. Still, the benefits of vertical gardens, such as temperature reduction and urban aesthetics, are more important in the long run than the cost. If governments and companies sit on their hands to save money, the UHI will intensify rapidly as a result, and eventually, new solutions in the future will require more money. At that time, we cannot eliminate the possibility that it is impossible to solve even if we spend more money. Since the cost associated with vertical gardens is likely to decrease as technology advances, there is a clear advantage in creating vertical gardens.

In conclusion, vertical gardens provide a promising solution for mitigating the urban heat island effect and creating sustainable and habitable green cities. Vertical gardens cool interior and exterior temperatures, promote energy efficiency, and provide additional advantages beyond UHI's solution. As cities grapple with urbanization, accommodating vertical gardens is an "imperative option" for designing thriving and harmonious environments. Vertical gardens will usher in a new chapter where a greener and healthier future exists.

## References

1. Basu, R., & Samet, J. M. (2002). Relation between Elevated Ambient Temperature and Mortality: A Review of the Epidemiologic Evidence. *Epidemiologic Reviews*, 24(2), 190-202. <https://doi.org/10.1093/epirev/mxf007>
2. Beatley, T. (2011). *Biophilic cities: Integrating nature into urban design and planning*. Washington, DC: Island Press.
3. Go, B. S., Park, J. E., & Hwang, T. Y. (2022). Case study on green wall effectiveness in public building for heat wave reduction and building energy saving, 6(4), 632-640. <https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artid=ART002834628>
4. Heat wave relief and warnings based on apparent temperature. (2022). Seoul Metropolitan government. <https://english.seoul.go.kr/heat-wave-relief-and-warnings-based-on-apparent-temperature/>
5. Ivanova, N., Ganzha, O., & Podkovyrov, I. (2020, August 1). Basic methodology in construction of vertical gardening of a building. <https://iopscience.iop.org/article/10.1088/1742-6596/1614/1/012034/meta>
6. Kim, J. W., Boo K. O., Choi, J. T., & Byun Y. H. (2018). 100 Years of Climate Change on the Korean Peninsula report. National Institute of Meteorological Sciences. <https://bit.ly/44fblRK>
7. Ksenzhek O. S., & Volkov A. G. (1998). Fluxes of Solar Radiation and Absorption of Light by Plants. *Plant Energetics*. (pp. 31-54). <https://doi.org/10.1016/B978-012427350-4/50003-0>
8. Nicolini, E., Germanà, M. L., Marcon, G., Chiodi, M., Gutiérrez, A., & Olivieri, F. (2022). Monitoring of the effect of solar radiation and rain on the building envelope with integrated vertical vegetation. *Building and Environment*, (Vol. 226) <https://doi.org/10.1016/j.buildenv.2022.109731>
9. Urban Heat Islands. (n.d). UCAR | Center for Science Education. <https://scied.ucar.edu/learning-zone/climate-change-impacts/urban-heat-islands>
10. What are Vertical Gardens? (n.d.). Ambius. <https://www.ambius.com/green-walls/what-are-vertical-gardens/>

# Big Data Cleans Air

Shengjie Li, Yuanqin High School, Hangzhou, China

Traffic emissions are a major source of air pollution in cities worldwide. The majority of gaseous pollutants are inhaled and mainly affect the respiratory system and can also induce hematological problems (CO, benzene) and cancer (Kampa and Castanas, 2008). In addition, poor air quality in urban environments can even cause higher temperatures, extreme weather such as dust storms. Not only individuals will be adversely affected, but the whole society will also face a great disaster caused by poor air quality. Fortunately, with the advancement of technology, people can process vast amounts of diverse data at high speeds. This new processing mode is called Big Data. By collecting massive amounts of data through Big Data to address limitations and obstacles encountered in natural and social field data analysis and processing, governments can better design landscapes that effectively absorb air pollutants on both sides of roads while strengthening the different fields' connection and civic engagement, and thus citizens of the city could be more willing to take green ways of traveling or commuting.

"Technological fixes are attractive because they bypass human behavior. They require that people do basically nothing" (Heberlein, 2012). Using Big Data, the government can directly collect environmental scientific data and analyze it, so that it can easily understand the environmental basis of a region to design a green landscape. According to a study conducted by Abhijith et al. (2017), in a street canyon environment, high-level vegetation canopies (trees) led to a deterioration in air quality, while low-level green infrastructure (hedges) improved air quality conditions. Thus, depending on Big Data to know about environmental conditions, the government can design suitable green belts that can effectively absorb exhaust gasses and prevent them from spreading into the open atmosphere on both sides of road, thus mitigating air pollution and heat island effects. This solution could, in a technical sense, go some way towards solving the urban air problem caused by traffic.

Besides, government road planning has played a key role in people's participation in tackling the problem of air pollution. Typically, the government will recruit few experts to collect and analyze information about the roads and design the roads according to their expertise, so decision-making actions are fragmented by disciplines and sectors, and the extent to which researchers are engaged in the policy-making processes remains unclear, so that decision-making cannot be informed in ways that maximize the synergies or minimize tradeoffs (Bai, 2016). With the use of Big Data, the government can collect the ideas of experts in different fields and even every ordinary citizen to bridge the gaps between different disciplines, sectors, and communities, breaking the sections and thus improving the accessibility (Bai, 2016). As a result, the government can make wiser decisions.

With more updated green designs on the sides of roads and more people involved, city dwellers will more proactively immerse themselves in nature and opt for healthier modes of travel such as cycling and walking rather than driving private cars. Through such actions, people's obesity problems and psychological anxiety problems can be effectively alleviated (Wolch et al., 2014). If there is no vegetation on both sides of the road and people are directly exposed to the fierce sun, especially in summer, then people will not be willing to walk or ride bikes because they feel uncomfortable, so they prefer to drive in the private car. However, the trees on either side of the road can provide shade and make them feel cool, so people's moods are happy when they are immersed in a green environment, and they are more willing to walk or ride in it. Gradually, they grew accustomed to this mode of traveling. Finally, their attitude has changed to consider this the best way to travel as they enjoy the natural scenery. Attitudes connected to our identities are often tied to

emotions and are much more difficult to change Ferkany (2014). As a result, people's reduced choice of motor vehicles reduces the emission of harmful gasses, thereby more effectively and permanently mitigating air pollution.

Some might argue that Big Data has a problem- that information is increasing at an exponential rate, but the improvement of information processing methods is relatively slower (Philip Chen and Zhang, 2014). However, in the face of the current rapid and dramatic climate crisis, Big Data has been able to contribute to the development of green cities efficiently enough. As a successful example, using big data and spatial information platforms to integrate information for adaptation planning, Singapore developed an island-wide digital urban climate twin (DUCT) by integrating relevant computational models (including environmental, land surface, industrial, traffic, building energy) as well as regional-scale and micro-scale climate models, effectively solving the urban air problems, switching to becoming a City in Nature and earning the nickname of the Garden City (Lin et al., 2021).

With the rapid development of the whole world, the air problem is becoming a major concern worldwide. No matter who a person is- governmental official, scientist, or ordinary citizen- everyone should pay attention to the problem and take action to solve it. This problem could be more effectively addressed by better green design, more comprehensive engagement and a stronger connection between man and nature when using new technologies - Big Data.

## References

1. Heberlein, Thomas. (2012). *Navigating Environmental Attitudes*. Oxford University Press, 4-10.
2. Lin, B. B., Ossola, A., et al. (2021). Integrating solutions to adapt cities for climate change. In *The Lancet Planetary Health* (Vol. 5, Issue 7, pp. e479–e486). Elsevier BV.
3. Abhijith, K. V., Kumar, P., et al. (2017). Air pollution abatement performances of green infrastructure in open road and built-up street canyon environments – A review. In *Atmospheric Environment*(Vol. 162, pp. 71–86). Elsevier BV.
4. Wolch, J. R., Byrne, J., et al. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough.' In *Landscape and Urban Planning* (Vol. 125, pp. 234–244). Elsevier BV.
5. Ferkany, M., Freed, A. L., et al. (2014). A Review of "Navigating Environmental Attitudes." In *The Journal of Environmental Education* (Vol. 45, Issue 2, pp. 134–137). Informa UK Limited.
6. Bai, X., Surveyer, A., et al. (2016). Defining and advancing a systems approach for sustainable cities. In *Current Opinion in Environmental Sustainability* (Vol. 23, pp. 69–78). Elsevier BV.
7. Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. In *Environmental Pollution* (Vol. 151, Issue 2, pp. 362–367). Elsevier BV.
8. Philip Chen, C. L., & Zhang, C.-Y. (2014). Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. In *Information Sciences* (Vol. 275, pp. 314–347). Elsevier BV.

# Park Accessibility: Green For Everyone

Sungjoon Park, Phillips Academy (Andover, MA), Seoul, South Korea

In recent years, the significance that green spaces hold in urban environments has gained increasing recognition. These areas not only contribute to the aesthetic beauty of cities and the preservation of the environment but also play an important role in facilitating the happiness of citizens. In this process of implementing urban parks, granting equitable access to green spaces has emerged as a pressing concern. According to the Trust for Public Land's ParkScore index, while 99% of citizens in Washington DC or Minneapolis live within 10 minutes of a park, less than half of citizens in Oklahoma City or Memphis have the same amount of access (Trust for Public Land, 2023). Hence, granting equitable access to this important resource remains a challenge. Using shared use agreements, redevelopment of land by moving existing structures, and facilitating community-led activities around parks, we can increase the equitable accessibility of green spaces.

Shared use agreements can play a crucial role in enhancing accessibility to parks, creating many benefits to the community. The largest dilemma regarding park accessibility is the limited amount of finances and spaces that are available compared to the vast amounts of land parks need to cover. Thus what we need to pursue is the concept of "mixed primary uses," (Jacobs, 2011) which enables one space to serve multiple purposes. Using shared use agreements, which are contracts between two entities regarding the sharing of property, we can develop areas that have the potential to become public green spaces such as community gardens, sports clubs, and school backyards, and open them to the public and "increase access to low- or no-cost recreational facilities for community members" (Omura et al., 2017). For example, according to the Kinder Institute for Urban Research, an organization called the SPARK Schools Park Program has transformed over 150 school playgrounds into community parks to increase park accessibility. Imagine a similar initiative, but instead of it being led by a nongovernmental organization relying on donations, led by the government on a state-wide or national scale, with a much larger budget. This not only optimizes the utilization of public spaces but also satisfies the needs of the original users of that space, as the effort to make the space a community park will result in that space becoming more developed.

Moving away existing structures to make way for green spaces could be a radical, yet effective solution. One example is the Cheonggyecheon Restoration Project in Seoul, Korea, an ambitious endeavor which successfully renewed a previously polluted stream while removing an elevated highway. The original road had lots of infrastructure which included "60,000 shops, [which employed] 800,000 workers, plus a large number of illegal street vendors" (Cho, 2010). In compensation, the mayor created "garden5", a commercial complex which includes malls, department stores, theaters, etc., so that the merchants could be granted spaces inside that complex for free. As a result, Cheonggyecheon has become a successful project, and a great model of urban renewal for countries around the world. Likewise, we can remove existing structures and redevelop areas to restore nature.

Besides the two aforementioned solutions which focus on creating more land, the existence of activities people can engage in these green spaces can facilitate community engagement which can foster a potential increase in park use. Locational problems are not the only reason many people are reluctant to use parks. Instead, "where a feeling of social inclusion was absent, the self-removal of individuals from community greenspace resources could be observed" (Seaman et al., 2010). In fact, some reasons why people do not use local parks included preferring to stay at home and preferring indoor activities, both reasons relating to the loss of social connections. If parks can create more activities that involve the community such as community gardening, sports events, cultural festivals or



picnics, pet activities, volunteering, or even afterschool care for children, it could make people feel more connected to the community and as a result increase park usage.

Some opposing viewpoints do exist which doubt the effectiveness of policies such as shared use agreements and redevelopment of land due to clashing interests of stakeholders. For example, parents may not want to open up school playgrounds to the public for safety-related reasons. However, detailed rules and regulations resulting from the discussion of these stakeholders can result in a healthy solution everyone can agree to. For example, the school and city can agree to implement a rule that opens up schools to the public only after a certain time in the day in order to preserve the students' safety.

In conclusion, shared use agreements, redevelopment of land, and community involvement activities are all promising solutions which can both create a larger quantity of green spaces and boost park usage. Through these measures which facilitate community engagement and make green spaces more accessible, we can create a city where all people can enjoy the full benefits of nature.

## References

1. ParkScore® 2023 scoring metrics. Trust for Public Land. (2023, May 24). <https://www.tpl.org/parkscore/rankings>
2. Omura, J. D., Carlson, S. A., Paul, P., Sliwa, S., Onufrak, S. J., & Fulton, J. E. (2017). Shared use agreements between municipalities and public schools in the United States, 2014. *Preventive Medicine*, 95, S53–S59. doi:10.1016/j.ypmed.2016.09.026
3. Jacobs, J., & Epstein, J. (2011). *The death and life of great american cities*. Modern Library.
4. For close to 40 years, spark parks have been bringing hyper-proximity to Houston neighborhoods: Kinder Institute for Urban Research. Kinder Institute for Urban Research | Rice University. (n.d.). <https://kinder.rice.edu/urbanedge/close-40-years-spark-parks-have-been-bringing-hyper-proximity-houston-neighborhoods>
5. Cho, M.-R. (2010). The politics of urban nature restoration: The case of Cheonggyecheon restoration in Seoul, Korea. *International Development Planning Review*, 32(2), 145–165. doi:10.3828/idpr.2010.05
6. Seaman, P.J., Jones, R. & Ellaway, A. It's not just about the park, it's about integration too: why people choose to use or not use urban greenspaces. *Int J Behav Nutr Phys Act* 7, 78 (2010). <https://doi.org/10.1186/1479-5868-7-78>
7. Ujtdewilligen, L., Waters, C. N.-H., Aw, S., Wong, M. L., Sia, A., Ramiah, A., ... Müller-Riemenschneider, F. (2019). The Park Prescription Study: Development of a community-based physical activity intervention for a multi-ethnic Asian population. *PLOS ONE*, 14(6), e0218247. doi:10.1371/journal.pone.0218247

# Promoting Extensive Green Roofs In Shanghai

Kaikun Chen, Shanghai Soong Ching Ling School, Shanghai, China

Green roofs (GRs) mitigate urbanization and climate change impacts by optimizing roof space, with benefits including reduced stormwater runoff, air pollution, urban heat island effects, and enhanced biodiversity, urban agriculture, and aesthetics. According to Green Roof Types (n.d.), there are three main types of GRs, extensive, intensive, and semi-intensive, which vary in weight load, plant selection, and maintenance requirements. Despite the early adoption of GRs in Shanghai, this promising environmental solution is still limited by misinformation and an illogical planning framework. In other words, Shanghai has often focused on the wrong type of GR variety and installation approach. According to Nie et al. (2023), the focus of GR construction will shift from new rooftops to existing rooftops, as the amount of land for new construction in urban areas continues to decrease. In addition, Luo et al. (2019) point out that extensive GRs have more potential to be popularized in existing buildings due to their low construction and maintenance costs and their suitability for a wide range of buildings. To increase the effectiveness and adoption of GRs in Shanghai, the government should promote the construction of extensive GRs on existing rooftops through subsidies and innovation incentives.

GR constructions that are led, funded, and organized by government agencies are often more efficient and persistent than the ones that are led by related units. Research by Nie et al. (2023) stresses the influence of district-level organization and management on GR construction. Government-planned and financed GRs in districts like Jing'an and Hongkou demonstrate effective functionality and longevity, while units responsible for construction and maintenance in other districts show less motivation and a higher likelihood of GR abandonment.

Since the direct economic benefits of GRs are not significant, policy subsidies and incentives are especially important to promote the construction of GRs. Nie et al. (2023) data indicates that policies and subsidies issued in multiple years, including 2008, 2012, 2014, and 2015-2018, led to increased GR construction in 2009, 2013, and 2015-2019, demonstrating the significant promotion of GRs in Shanghai through policy interventions.

Extensive green roofs (EGRs) are lightweight, cost-effective, and low maintenance. They feature thin soil layers, reducing weight and installation costs, and are planted with low-maintenance plant species, minimizing irrigation, fertilization, and pruning needs. The simpler design of EGRs, without irrigation systems or walkways, also contributes to lower installation and maintenance expenses (Berardi et al., 2014; Getter & Rowe, 2006).

EGRs are suitable for a wide range of building types, especially existing ones, making them promotable on a large scale. According to LUO et al. (2019), EGRs can be installed without significant structural modifications, making them cost-effective and feasible for a wide range of buildings. As mentioned above, they are particularly suitable for retrofitting existing buildings due to their lightweight nature and minimal maintenance requirements.

In addition to the benefits described above, EGRs have the problem of having a relatively short life span. In Shanghai, over 50% of intensive green roofs outlasted the median lifespan of three years, surpassing the 39% survival rate of EGRs. Furthermore, among the roofs that did survive, intensive green roofs demonstrated significantly longer longevity compared to EGRs. (Nie et al., 2023) This is influenced by the quality of GR construction and maintenance methods. The government should introduce relevant policies in terms of quality inspection and regulated maintenance. Besides, the

government can encourage scientific research to find plant species more suitable for Shanghai's climate, thus further prolonging the life span of EGRs.

In conclusion, green roofs (GRs) offer a valuable solution to mitigate urbanization and climate change impacts. To promote their adoption in Shanghai, the government should focus on extensive green roofs (EGRs) on existing rooftops through subsidies and innovation incentives. Government-led initiatives have shown greater efficiency, and policy subsidies have positively influenced GR construction. EGRs, with their lightweight nature, cost-effectiveness, and low maintenance requirements, are suitable for a wide range of buildings. Measures to address the relatively short lifespan of EGRs include quality inspection, regulated maintenance, and research for climate-appropriate plant species, which will enhance the effectiveness and adoption of GRs in Shanghai.

## References

1. Berardi, U., GhaffarianHoseini, A., & GhaffarianHoseini, A. (2014). State-of-the-art analysis of the environmental benefits of green roofs. *Applied Energy*, 115, 411–428. <https://doi.org/10.1016/j.apenergy.2013.10.047>
2. Getter, K. L., & Rowe, D. B. (2006). The role of extensive green roofs in sustainable development. *HortScience*, 41(5), 1276–1285. <https://doi.org/10.21273/hortsci.41.5.1276>
3. Green Roof Types. (n.d.). Green Roof Organisation. <https://www.greenrooforganisation.org/green-roofs/green-roof-types/>
4. LUO, T., SU, Y., & CHEN, S. (2019). A potential analysis of roof greening on existing buildings in highly urbanized areas: A case study of shanghai central city. *Landscape Architecture*, 26(1).
5. Manso, M., Teotónio, I., Silva, C. M., & Cruz, C. O. (2021). Green roof and green wall benefits and costs: A review of the quantitative evidence. *Renewable and Sustainable Energy Reviews*, 135(1364-0321), 110111. <https://doi.org/10.1016/j.rser.2020.110111>
6. Nie, P., Wang, H., Luo, T., Li, X., & Zou, F. (2023). Research on the evaluation of green roof construction and development in shanghai central city. *Landscape Architecture Academic Journal*, 40(4).

# Stormwater And Green Infrastructure

Sourish Dutta, Cornell University, Ithaca NY, United States

Stormwater management is critical in urban cities due to climate change and urbanization challenges. Development, impermeable surfaces, and outdated infrastructure increase flood risks and water pollution. Recent “land-use change is one of the common factors causing UHI and USF (Urban Storm flood)” (Liang et al., 2021), but green infrastructure offers effective solutions by integrating nature-based techniques to absorb and filter rainwater, minimize flooding, and mitigate pollution. Amenities such as rain gardens, bioswales, and permeable pavements mimic the natural water cycle, providing environmental, social, and economic benefits.. Green infrastructure offers one of the most effective solutions for stormwater management by integrating nature-based methods with the potential of absorbing and filtering rainwater, minimizing flooding risks, and mitigating thermal regulation failure.

Green infrastructure offers a compelling solution for stormwater management by harnessing the potential of absorbing and filtering rainwater – a feat previously unachievable using traditional drainage systems which struggled to handle the volume of rainfall, leading to flooding and water pollution. However, green infrastructure elements such as rain gardens, bioswales, and permeable pavements are designed to capture and retain rainwater, known as Process Control. Next, the retained water has the potential of being discharged downstream to “dry basins, ponds and wetlands, for temporary detention and slow discharge [which] contributes to flood prevention and water quality improvement through sedimentation” (Liu et al., 2019). Thus, by implementing controlled stormwater retention and discharge systems, the city can mimic the natural water cycle to improve water quality, protect aquatic ecosystems, enhance the overall health and resilience of their local watersheds, and control flooding risks. It also benefits marginalized communities that do not have access to water purification systems.

One of the key advantages of green infrastructure in stormwater management is its ability to minimize the risk of long term or flash floods. The risk of flooding originates from rapid urbanization which has effectively replaced “the natural land cover in the cities [...] with impervious surfaces which significantly alters the natural patterns and processes of urban landscape resulting in mismanagement of storm water and hence the flooding issues” (Kaur et al., 2022). To combat the risk of flooding, green infrastructure elements, such as vegetated swales and retention ponds, act as natural storage and conveyance systems, slowing down the flow of stormwater and allowing for gradual infiltration. By effectively managing the flow rate of stormwater, green infrastructure helps to mitigate the risk of flooding, protecting communities, infrastructure, and valuable ecosystems from the damaging impacts of excessive water flow.

Effective stormwater management plays a crucial role in thermoregulation within urban cities. By implementing green infrastructure methods such as bioswales, rain gardens, and green roofs, as discussed earlier, stormwater runoff could be diverted towards thermoregulation of the cities ambient temperature. Through multiple case studies conducted in the Fujian Delta urban agglomeration in China, it was discovered through experimental results that incorporating blue spaces “reduce the temperature through the evapotranspiration process of water [and] effectively cause neighborhood cooling due to increased air movement and heat exchange” (Shen et al., 2022). In addition to evapotranspiration, the usage of water as a medium with a high specific heat correlates to longer periods of heat exposure for temperature change in contrast to surrounding urban materials which have a lower specific heat capacity. As a result, heat transfer through forced convection occurs at the surface level which leads to lower average temperatures in the city. This benefits all citizens of a city,

especially lower-income residents who do not have access or financial resources to afford air conditioning or charges for extended periods of electricity use for operating a fan. Lower temperatures benefit surrounding ecosystems, water reservoirs, and human living conditions positively.

While green infrastructure offers promising solutions for stormwater management, there is a major challenge— heavy dependence on local conditions that vary city-to-city, such as soil type, available acreage, and hydrological patterns based on research about BGI (Blue Green Infrastructure) systems which can “ manage a certain volume of stormwater. This volume is directly related to the size of the effective impervious area” (Liu et al., 2019). The supported research paper analyzes two distinct experimental variables—Beijing and Copenhagen— to determine how BGI systems need to be adapted for those distinctly different cities. Primarily, tested analysis of green infrastructure has been conducted in specific cities with low margins of change for variable climatic conditions. A potential solution could be proposed to the invariability of the effectiveness of green infrastructure by gaining the support of the local residents to voice their most pressing concerns, whether it be frequent floods, lack of thermoregulation, or poor water quality, would help the urban city planners optimize their solutions to combat the most relevant issues on a case-by-case basis for every city.

In conclusion, green infrastructure presents a compelling solution for effective stormwater management in urban areas. Through elements like rain gardens, bioswales, and permeable pavements, green infrastructure minimizes flooding risks, mitigates water pollution caused by runoff and aids with thermal environmental regulation. If the natural resources available to every city is used to its maximum potential, there are significant benefits that can be reaped for the betterment and resilience development of the city and its residents.

## References

1. Liu, L., Fryd, O., & Zhang, S. (2019, September 28). Blue-Green Infrastructure for Sustainable Urban Stormwater Management—Lessons from Six Municipality-Led Pilot Projects in Beijing and Copenhagen. *Water*, 11(10), 2024. <https://doi.org/10.3390/w1110>
2. Shen, Z. J., Zhang, B. H., Xin, R. H., & Liu, J. Y. (2022, September). Examining supply and demand of cooling effect of blue and green spaces in mitigating urban heat island effects: A case study of the Fujian Delta urban agglomeration (FDUA), China. *Ecological Indicators*, 142, 109187. <https://doi.org/10.1016/j.ecolind.2022.109187>
3. Liang, C., Zhang, R. C., Zeng, J., & Shen, Z. J. (2021, July). A land-use decision approach integrating thermal regulation, stormwater management, and economic benefits based on urbanization stage identification. *Science of the Total Environment*, 779, 146415. <https://doi.org/10.1016/j.scitotenv.2021.146415>
4. Reyers, B., Biggs, R., et al. (2013). Getting the measure of ecosystem services: A social-ecological approach. *Frontiers in ecology and environment*, 11(5), 268-273. doi:10.1890/120144
5. Stern, M. J. (2018). *Social science theory for environmental sustainability: A practical guide*. Oxford, UK: Oxford University Press.

# Creating A Teen-Friendly Green City

Yaqing Yang, Chengdu Foreign Languages School, Chengdu, China

Urbanization has led to rapid growth and transformation of cities, but it has also raised concerns regarding children's safety and environmental awareness. Unfortunately, the needs and interests of children in matters of environmental sustainability often go unnoticed in current city planning practices (Bell and Ward Thompson, 2014). Constructing a green city is not only beneficial but crucial for the well-being of our children, the sustainability of our planet, and the development of our society (Rakhimova et al., 2022). Such an environment promotes healthy living, imparts valuable life skills, and prepares future generations to become responsible environmental stewards. This research paper proposes a solution to this problem: developing a biophilic city model that prioritizes children's safety and fosters their connection with the environment with strategies such as creating spaces for children to engage with nature, implementing green infrastructure, and establishing nature parks can contribute to the creation of a child-friendly green city.

Firstly, for balanced social-ecological progress in our rapidly urbanizing world, both governmental agencies and local communities have to jointly champion creating an eco-efficient city where the safety of children and environmental education is of paramount importance. This can be achieved by designing cities upon the principles of biophilic design, which include appreciating green construction practices and establishing environments that support outdoor recreation (Rakhimova et al., 2022). Initiatives of this nature can foster a balance between city life and nature, cultivate a thorough understanding of the environmental challenges we face among our younger generations, and provide a strong foundation for sustainable urban development in the future.

Secondly, in existing regulations for urban planning, the necessity and impact of nurturing a strong relationship between children and nature are often undervalued (Bell and Ward Thompson, 2014). Fostering this bond results in children developing environmental consciousness at an early age, thereby laying the groundwork for a society that is aware of its environmental impact. Integrating environmental education into school curricula and encouraging outdoor recreational activities can effectively strengthen this connection to nature, steering our society towards an eco-friendly future (Chawla, 2015). Additionally, an integral aspect of creating a sustainable city is the adoption of environmentally friendly construction materials. Although they may require higher initial investments, they offer a more sustainable solution than traditional, more polluting materials, and can significantly decrease the environmental footprint of architectural developments (Dadvand et al., 2015).

Additionally, while integrating green spaces into urban areas brings numerous benefits, it does pose challenges such as limited space, higher maintenance costs, and potential conflict with other urban development goals. However, these challenges can be overcome by implementing advanced approaches to urban planning and encouraging collaborations between governmental agencies, local communities, and private organizations (Rakhimova et al., 2022). The health, cognitive, and social benefits generated by green spaces further evince the necessity of creating such ecologically balanced cities (Dadvand et al., 2015). Innovative strategies, such as vertical gardens, rooftop gardens, and incorporating greenery into building designs, can address the issue of limited space in urban environments. Additionally, employing native plant species and environmentally friendly maintenance practices can reduce maintenance costs while still providing the desired benefits of green spaces. The collaboration between various stakeholders is essential to ensure that biophilic urban planning is harmoniously integrated with existing and future urban development goals, ultimately achieving a sustainable balance between urbanization and environmental conservation.

Although the implementation of biophilic cities may seem costly, the long-term environmental health benefits, as well as the potential savings from decreased healthcare costs and improved overall productivity, outweigh the initial expenses. Moreover, the upfront cost can be mitigated through innovative financing strategies and partnerships among local governments, nonprofit organizations, and private entities, pairing the necessary funding along with expertise and resources. It is crucial to recognize that the costs associated with inaction, such as deteriorating public health, loss of biodiversity, and environmental degradation, will likely far exceed the costs of proactively investing in biophilic urban development. In the long run, the promise of biophilic cities far supersedes the cost concerns, as they offer a more resilient, healthy, and sustainable urban environment for future generations (Brown et al., 2019).

In conclusion, biophilic cities that emphasize children's safety, environmental mindfulness, and green infrastructure demonstrate a promising model for future urban development practices (Brown et al., 2019). While creating these cities undoubtedly poses challenges, it is incumbent upon governments, communities, and individual citizens to work tirelessly to implement these sustainable urban solutions. The resulting cities will be able to balance rapid urban growth with responsible stewardship of natural resources, ensuring a viable world for future generations (Riggio, 2002). By fostering a strong connection between children and nature, we are empowering them to become environmentally responsible citizens who will carry forward the principles of biophilic urban planning, ensuring the legacy of sustainable development for generations to come. In this way, the transformation of our cities into biophilic, child-friendly spaces serves not only as an essential component of sustainable urban development, but also as a moral imperative to protect the well-being of our children and the planet they will inherit.

## References

1. Bell, S., & Ward Thompson, C. (2014). The role of natural environments in children's learning. *Children, Youth and Environments*, 24(2), 16-34.
2. Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature*, 30(4), 433-452.
3. Dadvand, P., et al. (2015). Green spaces and cognitive development in primary schoolchildren. *Proceedings of the National Academy of Sciences*, 112(26), 7937-7942.
4. Rakhimova, N., McAslan, D., & Pijawka, D. (2022). Measuring child-friendly cities: developing and piloting an indicator assessment tool for sustainable neighborhood planning. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 1-27.
5. Riggio, E. (2002). Child-friendly cities: good governance in the best interests of the child. *Environment and Urbanization*, 14(2), 45-58.
6. Brown, C., et al. (2019). Child-friendly cities. *Cities & Health*, 3(1-2), 1-7.



# Approaches To Improve Biophilic Activity, Knowledge, And Attitudes

Yang Wang

Biophilic cities are a concept created by Tim Beatley as an ideal model for future cities. Biophilic cities not only consider using renewable energy and reducing waste, but also focus on the presence of actual greenery and natural life-forms which humans species coevolved with (Beatley, 2011). Indicators of biophilic cities may include biophilic conditions and infrastructure, biophilic activities, biophilic attitudes and knowledge, and biophilic institutions and governance. Beijing, as the capital of China, has very well-built biophilic infrastructure systems that includes a Beijing Olympic Forest Park. However, residents in Beijing are not demonstrating pro-biophilic activities and attitudes that further support this infrastructure. An interview conducted by the Ministry of Ecology and Environment of the People's Republic of China in 2020 indicates that around 94.4% of the interviewees believe it's important to pay attention to environmental issues, but only 45.9% of them are constantly doing so, evincing a lack of pro-biophilic attitudes and knowledge. Although around 89.5% of the interviewees agree that it's important to participate in environmental protection volunteer activities, only 55.1% of them are actually participating (Investigation Report on Citizens' Ecological and Environmental Behavior, 2020). It is important to note that no single approach may address the problem of low biophilic activity, knowledge, and attitudes. Improving environmental education in schools, posting online advertisements on green products, and constructing environmental-relevant public utilities like zoos and parks can improve biophilic activity, attitudes and knowledge of Beijing citizens.

Enhancing environmental education in schools may enhance citizens' biophilic activity, knowledge and attitudes in the long run. Improving environmental education may include adding more environmental science courses. The environmental science school curriculum in high school should incorporate biology, chemistry, physics, physical geology and introduces students to key concepts, principals and theories within environmental science (Boersema, J. J., and Reijnders, L. 2009). By increasing the universality and the number of hours schools spend on it, students would be able to gain more biophilic knowledge through learning these varieties of topics and concepts related to the environment. Besides, investigations should be used in environmental courses to explain and understand the behavior of nature in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications (Boersema, J. J., and Reijnders, L. 2009). An average student's environmental knowledge scores can increase by 22% after they completed the environmental science course, and student's environmental attitudes become more environmentally favorable comparing the pre-course and post-course data (Bradley, J. C., Waliczek, T. M., and Zajicek, J. M. 1999). In this way, by improving environmental education, we may raise future citizens who have more biophilic knowledge and are more willing to participate in biophilic activities.

Posting on-line advertisements about environmentally friendly products may also help with promoting biophilic activity among citizens. Social media, as one of the most powerful communication tools ever created and used by human beings, can connect people who are miles away as if they're in the same room. This powerful tool can definitely be used for advocating green topics. Advertisements may be used to promote the sale of green products, which are the products with low carbon footprints and cause less pollution. Research found that green advertising may influence consumer attitudes to buy environmentally friendly products and encourage them to buy products that don't harm the

environment. Also, the credibility of green advertising significantly influences the purchase intentions of green products (Kusuma, P. N. P. D., and Handayani, R. B. 2018) . Therefore, by posting advertisements of environmentally green products with valid data, more citizens may decide to purchase the green products. By purchasing these green products, citizens are actively protecting their environment with their own purchase decisions, which in turn enhance their biophilic activity. The advertisements posted on-line can reach out to many people in the city, and at least some of them would be interested in the topic and decide to make the purchase. Considering the large population living in Beijing, that may be a considerable amount of people. In this way, posting on-line advertisements may increase citizens' biophilic action.

In addition, constructing environmental-related public utilities can also help solve the problem of lacking biophilic activity, knowledge and attitudes. The society is composed of vastly different populations, and the ones who are no longer in schools also need education about environmental issues and concepts. Public utilities like museums and zoos may provide them with accessible knowledge about the environment. Citizens may have a chance to learn more about environmental concepts and ideas in museums and closely observe how different animals can interact with their environment and therefore improve in biophilic knowledge. Also, incorporating biophilic design principles into the construction and planning of parks and zoos can further enhance the biophilic experiences. Biophilic design aims to reconnect people with nature by incorporating natural elements, such as vegetation, water features, and natural materials, into the built environment (Beatley, 2011). This design approach has been shown to reduce stress, enhance creativity, and improve overall well-being (Terrapin Bright Green. 2014, September 12). By including biophilic designs in the constructions, more citizens may be willing to go and practice biophilic activities of interacting with nature in exchange for better mental state and lower stress level, and they can also learn more information about the natural species along the way. In this way, constructing environmental public utilities can increase people's biophilic knowledge and also provide them with a space to practice the biophilic activities.

Admittedly, there are some drawbacks of the mentioned solutions to the question of low biophilic activities, knowledge and attitudes. The solutions may require a lot of money to implement them. For example, a community park that can accommodate up to 30 kids will cost around \$30,000, or around \$1,000 per child (Martins, A. T. 2023, January 14), and if we want to construct multiple of these or museums of the same size, the cost would only be higher. Also, adding more courses in schools can also raise the tuition and therefore become less accessible for the financially disadvantaged population.

The problem of inadequate biophilic activities, knowledge, and attitudes may be solved by improving environmental education in schools to create future biophilic citizens, posting online advertisements to increase people's purchase in green products, and building environmental related utilities to provide a place for citizens to conduct the biophilic activities.

#### References

1. Beatley, T. (2011). *Biophilic cities: Integrating nature into urban design and planning*. Washington, DC: Island Press.
2. Investigation Report on Citizens' Ecological and Environmental Behavior. 2020
3. Boersma, J. P. & Reijnders, L. (2009). *Principles of environmental sciences* (pp. 3-14). Netherlands: Springer.
4. Martins, A. T. (2023, January 14). How Much Does It Cost to Build a Community Park in 2023? Profitable Venture. <https://www.profitableventure.com/cost-build-community-park/>
5. Bradley, J. C., Waliczek, T. M., & Zaitcek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of environmental education*, 30(3), 17-21.
6. Kusuma, P. N. P. D., & Handayani, R. B. (2018). The effect of environmental knowledge, green advertising, and environmental attitude toward green purchase intention. *Russian Journal of Agricultural and Socio-Economic Sciences*, 78(6), 95-105.
7. Terrapin, Bright Green. (2014, September, 12). 14 Patterns of Biophilic Design. <https://www.terrapinbrightgreen.com/reports/14-patterns/>

# Equitable Access To Green Spaces

Yining Feng, Shanghai World Foreign Language Academy, Shanghai, China

In an era of rapid urbanization, uneven development of various areas within a city is commonplace. Shanghai presents a typical example of this issue. In the city, the extent of development in each district varies significantly. To be specific, the rapid development of the Pudong new district is accompanied by a dramatic increase in the number of buildings, causing fragmented green spaces, while other suburban districts demonstrate an increasing trend of green areas (Wu, Z. et al., 2019). The inequitable distribution results in unequal access to green spaces, thus leading to the diverse quality of life. To address this inequity, measures to increase these residents' access including revitalizing existing spaces by adding and reconstructing green spaces, increasing proximity and connectivity between residential areas and existing green areas, and educating local residents should be considered.

Revitalizing existing spaces can promote the more efficient use of limited urban areas. The urban land use, which means land already used for retailing, management, manufacturing, residence/housing, or industrial activities (Wang Y et al., 2006), in Pudong new district was 18.2% in 1994, it rose to 41.9% in 2000, and it continues showing an increasing trend, leaving limited area for vegetation (Wang Y et al., 2006). Since a large number of buildings exist and occupy the limited land, it's impossible to lay out any new parks anymore. As a result, rooftop gardens can be a good choice. With rooftop gardens on skyscrapers, people whether working or living there get convenient access to green spaces. They can not only provide better air quality by absorbing carbon emissions (Zhang, B. et al., 2014) but also offer recreational activities to help them relax (Tzoulas, K. et al., 2010), thus improving people's life quality. Furthermore, places such as open-air parking lots and schoolyards can be reconstructed by adding more vegetation. Since these places have heavy traffic and huge population flow, residents can easily get in touch with green plants. By making greener existing spaces in places with high land cover, the disproportionate distribution can be diminished and contact with greenery is increased, thus equitable access to green spaces can be achieved.

In addition, increasing proximity and connectivity between residential areas and existing green spaces provide residents with more opportunities to visit green areas. Currently, low connectivity usually occurs in both old and new town centers with high building density and low green cover (Tian, Y. et al., 2017). It's especially true in the Pudong new district. In order to have higher connections, residential buildings, parks, and gardens can be linked by constructing bike lanes and green corridors planted with trees. This enables residents to access green spaces. Convenient transportation using eco-friendly approaches including cycling and walking mitigates carbon emissions, contributing to a decrease in the level of global warming. Green corridors provide residents with better living conditions as well as chances to exercise themselves to strengthen their bodies. Through the way of improving connectivity, access to green areas can be achieved and quality of life can be improved.

Last but not least, education on residents to promote community engagement in green space development is crucial to achieve equitable access. By offering education on the benefits whether environmental or health-related, people's awareness of creating green spaces inside their neighborhood can be raised. They might be willing to build their gardens on their balconies, so everyone can thus access small green spaces at home, achieving equity. They will also be actively involved in the process of planning and decision. Public involvement is an innovative way that can not only reduce the cost and pressure on local governments (Kobori and Primack, 2003), but also provide citizens with a valuable opportunity to make relevant decisions more responsive to their diverse needs

(Shan X, 2012). Green space development can further improve its effectiveness and be enhanced by noticing the public's need to distribute vegetation proportionately (Shan X, 2012) and make it accessible to everyone.

For community engagement in developing green spaces, some scholars suggest that excessive and not well-organized public participation will lead to additional financial costs and the declining credibility of the government (Wouters, 2011). However, its advantages outweigh its disadvantages. It directly provides residents with opportunities to gain more knowledge about the environment and to personally implement. It also leads to higher efficiency in building green spaces that are most needed by the public, thus improving life quality (Shan X, 2012).

In conclusion, even though limitations exist in these approaches, they are overall effective in achieving the ultimate goal. By revitalizing existing spaces, increasing proximity and connectivity between residential areas and green spaces, and educating residents, people in denser building areas can increase their access to green spaces to the level of other people in the city. Therefore, equitable access to green spaces can be achieved. People can enjoy an equal quality of life with better living conditions.

## References

1. Wu, Z., Chen, R., Meadows, M. E., Sengupta, D., & Xu, D. (2019). Changing urban green spaces in Shanghai: trends, drivers and policy implications. In *Land Use Policy* (Vol. 87, p. 104080). Elsevier BV. <https://doi.org/10.1016/j.landusepol.2019.104080>
2. Wang Y, Li J, Wu J, Song Y. [Landscape pattern changes in urbanization of Pudong New District, Shanghai]. *Ying Yong Sheng tai xue bao = The Journal of Applied Ecology*. 2006 Jan;17(1):36-40. PMID: 16689230.
3. Tian, Y., Liu, Y., Jim, C., & Song, H. (2017). Assessing Structural Connectivity of Urban Green Spaces in Metropolitan Hong Kong. In *Sustainability* (Vol. 9, Issue 9, p. 1653). MDPI AG. <https://doi.org/10.3390/su9091653>
4. Shan, X.-Z. (2012). Attitude and willingness toward participation in decision-making of urban green spaces in China. In *Urban Forestry & Urban Greening* (Vol. 11, Issue 2, pp. 211–217). Elsevier BV. <https://doi.org/10.1016/j.ufug.2011.11.004>
5. Tzoulas, K., & James, P. (2010). Peoples' use of, and concerns about, green space networks: A case study of Birchwood, Warrington New Town, UK. In *Urban Forestry & Urban Greening* (Vol. 9, Issue 2, pp. 121–128). Elsevier BV. <https://doi.org/10.1016/j.ufug.2009.12.001>
6. Zhang, B., Xie, G., Gao, J., & Yang, Y. (2014). The cooling effect of urban green spaces as a contribution to energy-saving and emission-reduction: A case study in Beijing, China. In *Building and Environment* (Vol. 76, pp. 37–43). Elsevier BV. <https://doi.org/10.1016/j.buildenv.2014.03.003>
7. Wouters, M. (2011). Evaluating public input in National Park Management Plan reviews  
Department of Conservation  
<https://www.doc.govt.nz/documents/science-and-technical/sfc308entire.pdf>

# Food Waste In A First-Tier City, Beijing

Zihe Zhang, Beijing 21st Century International School, Beijing, China

Food waste is a pressing global issue with wide-ranging environmental, social and economic implications. As populations grow and consumption patterns change, food waste has reached alarming levels, wasting precious resources, contributing to greenhouse gas emissions, and exacerbating food insecurity and inequality. Food waste is particularly serious in first-tier cities such as Beijing (Djavan De Clercq, 2016). To address this complex issue, a comprehensive understanding of its causes, impacts, and solutions is essential. This article explores the causes of food waste and possible solutions. Create a more sustainable future by emphasizing efforts to eliminate food waste in order to mitigate environmental degradation and improve food security. Only in this way can Beijing better achieve a green city, that is, a sustainable city, and achieve various environmental protection goals. Therefore, through policies related to food waste, cooperation with local homeless and awareness education of wasting, we can reduce food waste in Beijing and create a fairer and more efficient food system.

In China, food waste is becoming more severe, and the primary reason is consumers' overbuying (Violeta Stancu, et al., 2016), so the government has introduced relevant laws to solve the food overconsumption problem. Data show that the food waste per capita in China's catering industry is as large as 93 grams per person per meal, with a waste rate of 11.7% (Peng Jing, Wang Yuran, 2022). That is to say, out of ten dishes in China, one dish is thrown away totally without eating. The average food waste rate in China is already so high, let alone in first-tier city Beijing. In 2021, Beijing introduced *the Beijing Municipal Anti-food Waste Regulation* (Standing Committee of Beijing Municipal People's Congress, 2021). It is clearly stipulated that when consumers eat in restaurants, if there is food waste, the leftovers will be charged a kitchen waste disposal fee. Such fines can help punish food wasters and curb food waste to some extent. The regulation also states that enterprises engaged in the catering industry must have a slogan on the wall, and catering enterprises must implement food waste measures. In addition, the government will give corresponding support and rewards to businesses that continue to reduce food waste. There is also a lot of food waste from Chinese traditional bad habits that were stipulated, such as holding banquets, funerals, wedding feasts and so on. These regulations have reasonably restricted, stopped and reduced food waste in Beijing. Although the law seems to be perfect, stipulating various aspects of food waste restraint, this law is still young and needs to be observed and revised by the government in the future. But in any case, can't we not legislate against food waste.

Secondly, we can recycle the leftovers (Marie\_Mourad, 2016). This is wasted food that is left on the table if it is never eaten. Restaurants could set up a free area where these "leftovers" that have never been eaten can be provided to the homeless and poor who can't afford food, that is, a kind of "collaboration" with the homeless. Secondly, recycling the food that has been used can be used to make feed and feed to pigs. We can give the leftover food to the pigs before it rots. The last point is to use bacteria such as mold to ferment food and finally make fertilizer (M. Fehr, et al., 2002), which is used in the land. This not only reduces food waste, but also fertilizes the land. The above three recycling methods can mainly be used to help people reduce food waste.

Finally, education has a significant impact on food waste, because we all know that many people don't know how to store food better, which leads to a lot of waste. Education, it seems, is also crucial when it comes to food waste. In terms of food preservation, most people in rural areas do not know how to preserve food well, and even some people in urban cities lack the knowledge of

preserving food. For example, bananas do not keep in the refrigerator and so on. By letting people know the shelf life and preservation methods of different foods, the food preservation rate can be effectively improved (Irfan Mujahid, et al., 2016). In addition, by exposing students to topics such as saving food earlier and more, students can cultivate the awareness of saving food from an early age, thus reducing the rate of food waste. The data showed that one university partnered with a catering company to introduce a food waste intervention that resulted in a 17% reduction in total food waste (Selena Ahmed, et al., 2018). This shows the potential of education for students.

The above article mainly describes three ways to reduce food waste. Although the introduction of the law seems to be mandatory and effective, it will make some citizens dissatisfied, which will lead to some demonstrations and so on. Governments can improve citizen satisfaction and make food waste laws more effective by adjusting laws to conform to public opinion. As for recycling, it seems that recycling food waste as animal feed is harmful to peoples' health (Anita Dame-Korevaar, et al., 2021), but this is not insoluble, people can speed up the transportation to prevent spoilage, or adopt the method of using all as fertilizer to avoid feeding poultry and human harm. Finally, if we want to improve the public's education on food waste, the government's expenditure may increase, and the tax will increase, which will lead to the rise of people's dissatisfaction. But the government can educate the public by saving money on food waste and landfills.

In conclusion, these three solutions can help reduce the problem of food waste in Beijing. Thus reducing the cost of disposing of these kitchen waste. Reduce people's ecological footprint and carbon emissions. In addition, the provision of leftover food to the homeless has increased citizen happiness, and the recycling of waste food as fertilizer has helped improve the quality of the soil, which is poor in Beijing. Finally, as part of the sustainable development plan, education provides a solid backing for this plan. Because without universal access to education, the impact of sustainable development will be low, leaving governments unable to act.

## References

1. Anita Dame-Korevaar, Iris J.M.M. Boumans, Adriaan F.G. Antonis, Ed van Klink, Evelien M. de Olde. (2021). Microbial health hazards of recycling food waste as animal feed, *Science direct*. <https://www.sciencedirect.com/science/article/pii/S2666833521000526>
2. Selena Ahmed., et al. (2018). Meeting the food waste challenge in higher education, *Emerald insight*. <https://www.emerald.com/insight/content/doi/10.1108/IJSHE-08-2017-0127/full/html>
3. Irfan Mujahid, Lukas Kornher. (2016). ASEAN Food Reserve and Trade: Review and Prospect Springer Link [https://link.springer.com/chapter/10.1007/978-3-319-28201-5\\_17](https://link.springer.com/chapter/10.1007/978-3-319-28201-5_17)
4. Kunwar Paritosh, Sandeep K. Kushwaha, et al. (2017) Food Waste to Energy: An Overview of Sustainable Approaches for Food Waste Management and Nutrient Recycling *Hindawi* <https://www.hindawi.com/journals/bmri/2017/2370927/>
5. M. Fehr, M.D.R. Calçado. (2002). The basis of a policy for minimizing and recycling food waste, *Science direct*. <https://www.sciencedirect.com/science/article/abs/pii/S1462901102000369>
6. Marie Mourad. (2016). Recycling, recovering and preventing "food waste": competing solutions for food systems sustainability in the United States and France, *Science direct*. <https://www.sciencedirect.com/science/article/abs/pii/S0959652616301536>
7. Violeta Stancu, Pernille Haugaard, Liisa Lähteenmäki. (2016). Determinants of consumer food waste behaviour: Two routes to food waste, *Science direct*. <https://www.sciencedirect.com/science/article/abs/pii/S0195666315003992>
8. Standing Committee of Beijing Municipal People's Congress. (2021). *Beijing anti-food waste regulations*, The People's Government of Beijing Municipality. [https://www.beijing.gov.cn/zhengce/dfxfq/202105/t20210528\\_2400412.html](https://www.beijing.gov.cn/zhengce/dfxfq/202105/t20210528_2400412.html)
9. Peng Jing, Wang Yuran. (2022). *The anti-food waste law has been in effect for more than a year and "CD" has become a new fashion among young people*, *People.cn*.
10. Djavan De Clercq, Zongguo Wen, Fei Fan, Luis Caicedo,. (2016). *Biomethane production potential from restaurant food waste in megacities and project level-bottlenecks: A case study in Beijing*, *Science direct* <https://www.sciencedirect.com/science/article/abs/pii/S1364032115017062>



# Stakeholder Engagement For Yangtze River Sustainability

Zijian Peng, Wuhan Britain China School, Wuhan, China

The Yangtze River, known as the "mother river" in China, is highly significant as it flows through different provinces, including the beautiful lakes of Hubei province. However, the rapid growth of industry and tourism has led to varying pollution levels in the river. To ensure fair access for all provinces, it is crucial for the government and society as a whole to work together. This research paper aims to tackle the challenge of encouraging active participation from various stakeholders in understanding and protecting the Yangtze River. It explores effective strategies to enhance stakeholder engagement, outlines necessary protective measures, and evaluates regulatory or market-based solutions. Moreover, the paper examines obstacles related to behavior, structure, and governance that must be overcome for successful implementation. Ultimately, sustainable management of the Yangtze River depends on engaging government bodies, local communities, industries, and environmental organizations through collaborative decision-making and effective communication.

Collaborative decision-making is essential for engaging stakeholders effectively. According to Wang et al. (2020), this process is vital for incorporating diverse perspectives and expertise, enabling inclusive and well-informed decisions. By considering stakeholders' concerns and interests, collaborative decision-making allows valuable insights and traditional knowledge from local communities, as observed in Yangtze River water quality improvement projects (Von Korff et al., 2012). This inclusive approach fosters stakeholder ownership and empowerment, strengthening their commitment to sustainable river management. Wang et al. (2020) further supports the benefits of involving multiple stakeholders, highlighting improved sustainability and legitimacy resulting from collaborative decision-making. Critics argue that such processes may be time-consuming and hinder urgent environmental measures. However, while collaborative decision-making may require more upfront time, it leads to more effective and sustainable solutions in the long run. Reed (2008) emphasizes that inclusive decision-making produces better outcomes, enhancing decision quality and garnering long-term stakeholder support by incorporating diverse perspectives and knowledge into the process.

Establishing transparent and accessible communication channels is crucial for engaging stakeholders effectively (Liu et al., 2021). Regular dialogue, information sharing, and public awareness campaigns play a vital role in educating stakeholders about the importance of sustainable management of the Yangtze River and the potential consequences of inaction. Effective communication builds trust and facilitates cooperation among stakeholders with diverse interests and goals (Li et al., 2019). For example, targeted awareness campaigns can educate industries about sustainable practices and encourage their active involvement in pollution reduction efforts. Liu et al.'s (2021) research emphasizes the significance of stakeholder engagement through communication for sustainable water management. Transparent and accessible communication channels enable the exchange of information and knowledge, fostering a shared understanding of the challenges and potential solutions. This builds trust among stakeholders and creates a collaborative environment for effective river management. Skeptics may argue that communication efforts can be ineffective in reaching all stakeholders, particularly those with limited access to information or not actively involved in environmental issues. While reaching all stakeholders can indeed be challenging, diverse



communication strategies can overcome these barriers. Utilizing various channels such as social media, community meetings, and local media outlets can help disseminate information widely. Additionally, involving community leaders and local influencers can reach marginalized groups. Ensuring inclusivity and accessibility in communication efforts facilitates engagement with a broader range of stakeholders.

Combining economic incentives and regulatory measures can encourage stakeholders' active participation in safeguarding the Yangtze River. Economic incentives, such as tax benefits or subsidies for environmentally friendly practices, can motivate industries to adopt sustainable production methods (Liao et al., 2018). Strict environmental regulations and standards ensure stakeholder accountability and minimize the negative impact on the river's ecosystem (Jiang et al., 2017). A combination of voluntary initiatives and regulatory frameworks balances economic growth and environmental protection. Liao et al. (2018) emphasizes the importance of fiscal and financial policies for industrial environmental pollution control. Well-designed policies and economic incentives effectively encourage industries to adopt environmentally friendly practices. Furthermore, Jiang et al. (2017) highlight the significance of strict regulations in holding stakeholders accountable and minimizing the negative impact on the river's ecosystem. Critics argue that relying solely on economic incentives and regulations may not be sufficient to motivate stakeholders if the economic benefits are inadequate or compliance costs are high. However, economic incentives and regulations play a crucial role in creating a supportive environment for sustainable management, although they are not the sole drivers of stakeholder engagement. Well-designed economic incentives effectively motivate industries to adopt environmentally friendly practices (Liao et al., 2018). Strict regulations provide clear guidelines and consequences for non-compliance, ensuring stakeholders prioritize the environment. When combined with collaborative decision-making and effective communication, economic incentives and regulations become powerful tools for motivating stakeholders to actively participate in the sustainable management of the Yangtze River.

Critics argue that collaborative decision-making, transparent communication, and the use of economic incentives and regulations face challenges and limitations. They contend that lengthy deliberations and consensus-building can hinder urgent environmental measures, and reaching all stakeholders through communication channels may be difficult despite diverse strategies. Moreover, relying solely on economic incentives and regulations may not sufficiently drive stakeholder behavior change. Critics also highlight the need to overcome behavioral, structural, and governance-related obstacles for effective stakeholder engagement.

Engaging multiple stakeholders through collaborative decision-making processes, effective communication channels, and the use of economic incentives and regulations is crucial for achieving sustainable management of the Yangtze River. By involving government bodies, local communities, industries, and environmental organizations, a comprehensive and inclusive approach can be taken, resulting in better-informed decisions, heightened stakeholder commitment, and increased long-term success. These strategies aim to protect the Yangtze River, creating a more sustainable, equitable, and resilient habitat for present and future generations.

## References

1. Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141(10), 2417-2431.
2. Jiang, Y., et al. (2017). Balancing industrial development and environmental sustainability: A comparative analysis of regulations and practices in China and the United States. *Journal of Cleaner Production*, 166, 1437-1447.
3. Liao, S., et al. (2018). Evaluation of fiscal and financial policies for industrial environmental pollution control in China: Achievements, challenges, and prospects. *Journal of Cleaner Production*, 176, 1257-1267.
4. Li, S., et al. (2019). Stakeholder communication and cooperation for sustainable urban development in China. *International Journal of Environmental Research and Public Health*, 16(16), 2914.
5. Liu, Y., et al. (2021). Stakeholder engagement for sustainable water management: A systematic review and theoretical framework. *Journal of Environmental Management*, 293, 112896.

# Food Gardens In Low-Income Communities

Zimo Fan, The Experimental High School Attached to Beijing Normal University,  
Beijing, China

How many green spaces are located in your neighborhood, and how many are in the neighborhood of your minority fellow? By carefully analyzing the distribution of green spaces, scientists found that census tracts with higher poverty rates or higher percentages of people of color were less likely to have access to green spaces (Wen et al., 2013). However, as a sort of public investment, green spaces ought to benefit all communities equally, rather than differentiate accessibility among distinct groups of people (Boone et al., 2009). In addition, given that parks provide people with opportunities for regular nature interaction, which promotes public health, it is of significant importance to promote public parks in communities mostly resided by minority people (Chawla, 2015; McCormack et al., 2010; Wolch et al., 2014). By organizing people in the communities to build food gardens in low-income communities, residents could receive benefits in their mental and physical health, and gain more food supply at the same time.

Building food gardens can serve as a powerful cure for mental issues. A study on the results of 130 ecotherapy initiatives conducted by the UK nonprofit Mind in England, defined ecotherapy as a strategy for enhancing both mental and physical health and wellness that encourages individuals to engage in outdoor activities like gardening, food production, or environmental work. In addition, the effect of gardening is supported by the example of volunteer's feedback to Cherry Tree Nursery, an activity in which volunteers with long-term mental health problems were organized to build a garden. Among 67 people who were interviewed, 94% of them reported that joining Cherry Tree has had a favorable impact on their mental health (Calleau, 2005).

Physical health is another benefit of food gardens. There is proof that being among greenery helps lessen the effects of cancer. By modifying air pollution levels, green space may act as a mediator for lung cancer, which has been linked to chronic exposure to air pollution (Kondo et al., 2018; Pope et al., 2002). Also, the exposure to green spaces is also correlated with the risk of cardiovascular disease (CVD). In a cohort of people (aged 45-72) living in Kaunas City, Lithuania, Tamosiunas et al investigated the relationship between exposure to green space (distance from house to nearest park, and self-reported park usage), and indicators of CVD. They discovered that people (particularly males) who resided nearer to the green areas had a lower risk of both fatal and non-fatal CVD.

The food gardens could act as an effective measure to solve food insecurity, which is severe, among low-income people. According to data from the USDA, 11.1 percent of American families, or around 36 million individuals, experienced food insecurity at some point in 2007, and 4.1 percent of people were deemed to have extremely low food security (Birch et al., 2008). For most people who are enduring food insecurity, the main reason for their suffering is the insufficiency of money and resources for food supply. Therefore, an increase in food supply from building food gardens that grow corn, wheat, rice and vegetables could help to improve the situation that low-income populations are in.

While food gardens could provide great benefits to low-income populations, there might be concern that people may not be willing to spend time cultivating croplants, since they will not earn money directly from such a time-consuming action. However, it is noticeable that building food gardens will bring people with more merits than side effects. Typically, people who just reach the national poverty line need to spend 30% of their disposable income on food after housing

expenditures (Orshansky, 1965), and they are likely to plant food to lower the percentage of income spent on food. Furthermore, those whose food security could not be ensured will probably rely on working on food gardens to create food. Consequently, creating food gardens could be an ideal means to favor people in low-income communities.

In conclusion, building food gardens in low-income neighborhoods and encouraging locals to produce the crop plants might serve as an effective way to help people lead better lives, with advantages for mental health, physical health, and food security.

## References

1. Wen, M., Zhang, X., Harris, C. D., Holt, J. B., & Croft, J. B. (2013). Spatial disparities in the distribution of parks and green spaces in the USA. *Annals of Behavioral Medicine*, 45(suppl\_1), S18-S27.
2. Boone, C. G., Buckley, G. L., Grove, J. M., & Sister, C. (2009). Parks and people: An environmental justice inquiry in Baltimore, Maryland. *Annals of the association of American geographers*, 99(4), 767-787.
3. Rigolon, A. (2016). A complex landscape of inequity in access to urban parks: A literature review. *Landscape and Urban Planning*, 153, 160-169.
4. Calleau, J. (2005). The benefits of volunteers attending Cherry Tree Nursery. *GrowthPoint-The Journal of Social and Therapeutic Horticulture*, 101, 20-22.
5. Schmutz, U., Turner, M. L., Williams, S., Devereaux, M., & Davies, G. (2014). The benefits of gardening and food growing for health and wellbeing.
6. Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2018). Urban green space and its impact on human health. *International journal of environmental research and public health*, 15(3), 445.
7. Hallberg, B., & Stephenson, M. (2009). Using community gardens to augment food security efforts in low-income communities. Blacksburg VA: Virginia Technical University.
8. Nelson, M., Dick, K., & Holmes, B. (2002). Food budget standards and dietary adequacy in low-income families. *Proceedings of the Nutrition Society*, 61(4), 569-577.

# Regenerative Urbanism: Ecological Harmony

Zhangnian Sun, Princeton High School, Princeton, United States

With the rapid development of technology and the potent influence of commercialization, the process of economic globalization has paved the way for the advance of urbanization. However, recent studies have revealed that metropolitan areas have higher death rates due to greater exposure to pollution (National Library of Medicine, 2021) and worsening climate change (City of Chicago and EPA), reflecting the lack of sustainability and equity in most modern cities due to biodiversity loss caused by urbanization. Here, in order to construct sustainable, equitable, ecological friendly cities, for not only the happiness and flourishing lives of humans but for all living organisms - we propose the application of regenerative designs in future urban developments (Cole, 2011); unlike “green designs”, regenerative designs not only emphasize on green space expansion but also promote effective resource utilization and ecosystem restoration to improve urban resource availability, equity, and health through a more interactive and more adaptive approach.

One unique feature of regenerative designs that differs from green designs and contributes to urban resource availability is the innovative thinking of applying regenerative resource designs to urban architectures. For instance, the installation of a small scale rainwater harvesting system starts with rainwater collection from house roofs, and collected rainwater will go through a filter to remove debris. Last, the filtered water will be stored in a water tank, the stored water can be either used for gardening or producing potable water by going through a treatment system (Alim et al. 2019). Economically, the concept of “scarcity” tells us that while human wants are inexhaustible, the availability of resources is very limited. This concept also applies to potable water availability - 96.5% of Earth’s water is salt water and only about 2.5% is fresh water (Stephens et al. 2020). Such a system can be applied to any household to address future water shortage problems in cities as the world’s population in urban areas is expected to increase 68% by 2050 (UN, 2018). Certainly, the effective utilization resource also can refer to the generation of energy. For example, the design proposal for the Liget Museum of Ethnography emphasizes the use of solar radiation to produce energy, and it also possesses natural ventilation and solar control to optimize energy efficiency, which can be used as a reference in future urban construction projects.

On the other hand, while regenerative designs also promote green space expansion, they focus more on ecosystem restoration through biomimicry. Biomimicry is an idea of simulating natural systems to address problems caused by human activities. By applying biomimicry to urban designs, it brings multifunctionality to buildings, such as: resource production, resource purification, and heat island effect mitigation (Zari and Hecht, 2020). This is because while biomimicry infrastructures emulate the conditions of a natural environment, habitats are formed to allow species interactions. As natural ecosystems integrate into modern cities, plants in cities are able to clean carbon dioxide through photosynthesis and slow down surface runoff, improving both air and water quality and mitigating increasing temperature throughout the entire urban area while serving as the primary producer in an ecosystem.

In addition, the simulated ecosystem in urban areas is also beneficial for human health. Back in 1839, the idea that the environment is therapeutic and has a significant effect on human conditioning was already highlighted by the *Lexicon Medicum*. Recently, studies have shown that patient immersion in nature contributes to patient recovery in healthcare facilities, workplaces, children's spaces, community spaces, and more (Totaforti, 2021). In explanation of this discovery, Totaforti states that, “humanity evolves through adaptive responses to natural conditions and natural

stimuli, such as sunlight, plants, animals, water and landscapes.” As the environment continues deteriorating over time, spending time in nature may not be recommended. However, Totaforti further mentions that, through contact with nature after restoring ecosystems back into cities - patient sensory experience will be enriched through vision, hearing, smell, and touch, ultimately boosting the parasympathetic system, lowering stress levels and improving overall wellbeing.

Although many may argue that expanding green space is the easy part, the installation of resource or energy production systems and environmental care can be financially and labor intensive. Such problems are not insolvable. In the installation of resource or energy production systems, the application of the system should be proportional to the regional environmental conditions to maximize the availability of the generated resource or energy. For example, the size of the water tank for the rainwater harvesting system should be determined by the regional precipitation data. On the other hand, the labor force required for urban environmental care can be addressed by civic participation until small-scale ecosystems are restored.

Regenerative design is not limited to making changes for the betterment of the environment, the concept of such design is applied to turn negative environmental impacts into favorable terms for the survival of all living organisms. As Darwinism highlights the idea of “survival of the fittest” - in order to survive in extreme, vicious conditions, innovative creativity is essential in future regenerative designs to build sustainable, equitable and resilient green cities.

## References

1. Zari, M. P., & Hecht, K. (2020). Biomimicry for Regenerative Built Environments: Mapping Design Strategies for Producing Ecosystem Services. MDPI. <https://doi.org/https://www.mdpi.com/714082>
2. Calleja-Agius, J., England, K., & Calleja, N. (2020). The Effect of Global Warming on Mortality. PubMed Central. <https://doi.org/10.1016/j.earlhumdev.2020.105222>
3. Thomson, G., & Newman, P. (2016). Geoengineering in the Anthropocene through Regenerative Urbanism. MDPI. <https://doi.org/10.3390/geosciences6040046>
4. Totaforti, S. (2018). Applying the benefits of biophilic theory to hospital design. *City Territ Archit* 5, 1. <https://doi.org/10.1186/s40410-018-0077-5>
5. Stephens, G. L., et al. (2020). Earth's water reservoirs in a changing climate. *The Royal Society*. <https://doi.org/10.1098/rspa.2019.0458>
6. Cole, R. J. (2011). Transitioning from green to regenerative design. *Building Research & Information*. <https://doi.org/10.1080/09613218.2011.610608>