

COLUMBIA SCHOOL OF
INTERNATIONAL AND PUBLIC AFFAIRS

CLIMATE CHANGE RELIEF FOR URBAN AREAS ACT OF 2023

Randall's Island, Aditya Mistry, 2024



FINAL REPORT

December 2024

Prepared by

MPA ESP WORKSHOP TEAM

*Fatou Kiné Gueye, Shunge
(David) Zhang, Caroline
Benedetti, Aditya Mistry, Kimberly
Liu, Jada Johnson, Maya
Williams, Diksha Boken, Yingjie
Xu, Wenshuang (Vincy) Wu*



TABLE OF CONTENTS

Acknowledgments	iii
Executive Summary.....	iv
Background 1.0	1
Introduction 1.1	1
Legislative Summary 1.2	2
Section 2: Forestry Assistance 1.2.1	
Section 3: Pilot Grant Program for School Rooftop Gardens 1.2.2	
Background of the Environmental Problem 1.3	3
Urban Heat Island Effect 1.3.1	
Flooding 1.3.2	
Public Health Impacts 1.4	4
Heat-Related Illness 1.4.1	
Asthma 1.4.2	
Food Deserts 1.4.3	
Environmental Justice Lens 1.5	8
Issue and Political Analysis 1.6	8
Case Study: An Environmental Justice Perspective in Houston	9
Current Work 1.7.....	10
Conclusion 1.8	12
Case Study: Heat Vulnerable Neighborhoods in Philadelphia	13
Program Implementation 2.0	14
Introduction 2.1	14
Section 3 Focus 2.2	15
Considerations of the Program Design 2.3	16
Economic Burden Approach 2.3.1	
Human Health Approach 2.3.2	
Environmental Impact Approach 2.3.3	
Program Design Choice 2.3.4	
Sprout Program Design 2.4	18
Program Logistics 2.5	19
Staffing and Tasks 2.5.1	
Budget 2.5.2	
Measures of Success 2.6	23
Input Measures 2.6.1	
Output Measures 2.6.2	
Impact Measures 2.6.3	
Conclusion 2.7.....	28
Case Study: Rooftop Garden on NYC Public School 41	29
Conclusion 3.0	30
Appendices & Works Cited	



Clarence Webb of Grow Dat Farm
Image from Kirsten Strough of USDA, via Flickr

ACKNOWLEDGEMENTS

We, the authors of this report, recognize that the land occupied by the government of the United States holds traditional and ancestral significance to a multitude of Indigenous peoples. Columbia University is located on the island known as Manhattan, which is part of the traditional and ancestral homeland of the Leni-Lenape and Wappinger people. We aim to address issues of community exclusion, erasure, and discrimination through our commitment to equity and justice, as well as ongoing education and advocacy efforts.

This report, under the guidance of Professor Louise Rosen, was developed by the following candidates for the Master of Public Administration in Environmental Science and Policy (MPA-ESP) at Columbia University's School of International and Public Affairs (SIPA):

- Fatou Kiné Gueye, Manager
- Shunge (David) Zhang, Deputy Manager
- Caroline Benedetti, Graphic Designer
- Aditya Mistry
- Kimberly Liu
- Jada Johnson
- Maya Williams
- Diksha Boken
- Wenshuang (Vincy) Wu
- Yingjie (Jay) Xu

Finally, the team recognizes and thanks the following experts who contributed insights during the research process:

- Jason Smith - Director, Northern Manhattan Parks, New York Restoration Project
- Mary-Virginia Potter - Education Specialist of EPA Office of Environmental Education
- Sharonte Williams - Grant Management and Program Analyst in the Grants and Agreement department at the OUAIP



EXECUTIVE SUMMARY

The population of the United States in 1960 was approximately 176 million people, and that number increased to 341 million people in 2024, which represents a 50% increase (“U.S Urban Population 1960-2024”, 2024). Between 1950 and 2024, the urban population increased by 19%, going from 64% of the population living in urban areas to 83% (“U.S. Cities Factsheet”, n.d.). However, it is estimated that by 2050, over 90% of the population will be urban with only 6% of the country being urban land area (“U.S. Cities Factsheet”, n.d.). This rapid urbanization has led to increasing environmental and socio-economic challenges, particularly in vulnerable communities. This dense development and reduced green spaces will exacerbate the effects of climate change. Rising temperatures, extreme weather events, and worsening pollution disproportionately impact Black, Indigenous, and People of Color (BIPOC) communities. Systemic racism and historical practices like redlining have perpetuated cycles of disinvestment, leaving these neighborhoods without the necessary infrastructure—such as green spaces—to mitigate environmental hazards.

This report describes the targeted program designed by our team to implement Section 3 of the federal bill H.R. 2786, the Climate Change Relief for Urban Areas Act of 2023. This bill was introduced to develop green infrastructure to mitigate the effect of rising temperatures and help reduce surface temperatures in specific areas. The United States Department of Agriculture

(USDA) will implement the bill programs, which serve to expand green infrastructure and allocate rooftop garden grants for public schools in designated areas.

The report first summarizes the legislation, outlining the key elements and intent of H.R. 2786. Following this, it delves into the background of the problem, addressing externalities to urbanization such as urban heat island effects, heat-related illnesses, flooding and stormwater runoff, and food deserts. These sections underscore the need for intervention and highlight how these interconnected issues create a burden that falls disproportionately on marginalized urban communities. The case study of Houston, Texas illustrates the real-world impacts of existing urbanization, offering insight into the systemic inequalities exacerbated by environmental challenges. The program design section details the rationale for prioritizing Section 3 of the bill, emphasizing its potential economic, human health, and environmental benefits. It introduces the SPROUT program, and the intended implementation mechanism of Section 3, and highlights specific program elements and considerations. The section then details personnel, financial, and time-based logistics for the first year of implementation, which is designed around Garden Equity Score development and formation of the grant application process. In conclusion, the report highlights performance indicators and provides immediate and long-term steps necessary to achieve the program’s goals. ■



Section 1

Background



Manhattan, Kimberly Liu, 2024

1.1 Introduction

The Climate Change Relief for Urban Areas Act of 2023 seeks to address many of the environmental problems experienced by urban communities today, especially for communities facing environmental injustices. Studies have shown that temperatures in urban centers average 1- 7°F higher during the day and 2 -5°F higher at night (U.S. Environmental Protection Agency n.d.). This leads to associated heat-related illnesses, especially in children and older

people. According to the data from the Centers for Disease Control and Prevention, an average of 702 heat-related deaths occurred in the United States annually between 2004 and 2018, with a disproportionate impact in urban areas (Center for Disease Control n.d.).

Also, extreme weather is intensifying, some regions with rapid precipitation cause stormwater runoff, and other regions experience drought. The frequency of heavy precipitation

events has increased by 55% in the Northeast and 42% in the Midwest from 1958 through 2016, which exacerbates the problem of stormwater runoff (Great Lakes Integrated Sciences and Assessments 2024). On the other hand, in the southwestern United States, climate change has increased the intensity of drought by 30% to 50% and these areas are experiencing prolonged drought (NASA n.d.). These climate patterns put enormous pressure on water management systems, causing some problems relative to public health and the economy. Moreover, low-income communities and/or communities of color face disparate impacts that greatly affect their livelihoods, including health, and economic and social mobility. The bill ultimately aims to address urban environmental issues with an environmental justice lens to deliver the benefits of green infrastructure to communities, especially those experiencing the greatest need.

1.2 Legislative Summary

The Climate Change Relief for Urban Areas Act of 2023, introduced by Democrat Adam Schiff in the 118th Congress (2023-2024), attempts to mitigate high surface temperatures in urban areas through urban greening initiatives. The bill mandates the reprioritization of federal forestry funding and the creation of a pilot grant program for school rooftop gardens in disadvantaged communities. Funding must prioritize communities with low Tree Equity Scores and Garden Equity Scores, which would be based on factors like population density, racial composition, respiratory illness incidence, income, and average surface temperature and have yet to be developed (Schiff 2023). Communities like these often fall under the category of “environmental justice communities”, as environmental and

socioeconomic data around those communities would reveal that they are facing disparate impacts. Thus, while the term is not explicitly stated in its language, the bill seeks to target environmental justice communities.

1.2.1 Section 2: Forestry Assistance

Section 2 of The Climate Change Relief for Urban Areas Act of 2023 amends Section 9 of the Cooperative Forestry Assistance Act of 1978 (codified as Title 16, Section 2105 of the United States Code) (Cooperative Forestry Assistance Act of 1978 1978). It prioritizes urban and community forestry assistance communities with low tree equity scores. The bill mandates the USDA to create a tree equity score similar to that of American Forests and is determined by how the tree canopy and surface temperature of the area align with income, employment, race, age, and health factors (Schiff 2023).

1.2.2 Section 3: Pilot Grant Program for School Rooftop Gardens

Section 3 of The Climate Change Relief for Urban Areas Act of 2023 proposes that a new pilot grant will provide funds to construct rooftop gardens at public elementary and secondary schools. The bill empowers the USDA to create a garden equity score based on factors like population density, racial composition, respiratory illness incidence, number of urban gardens, food sovereignty, and average surface temperature to prioritize communities eligible for funding. Grantees can use the funds to assess, design, and establish the rooftop gardens. The bill also requires grantees must select native species as 20% of the vegetation, farm organically, and implement an urban agriculture or environmental

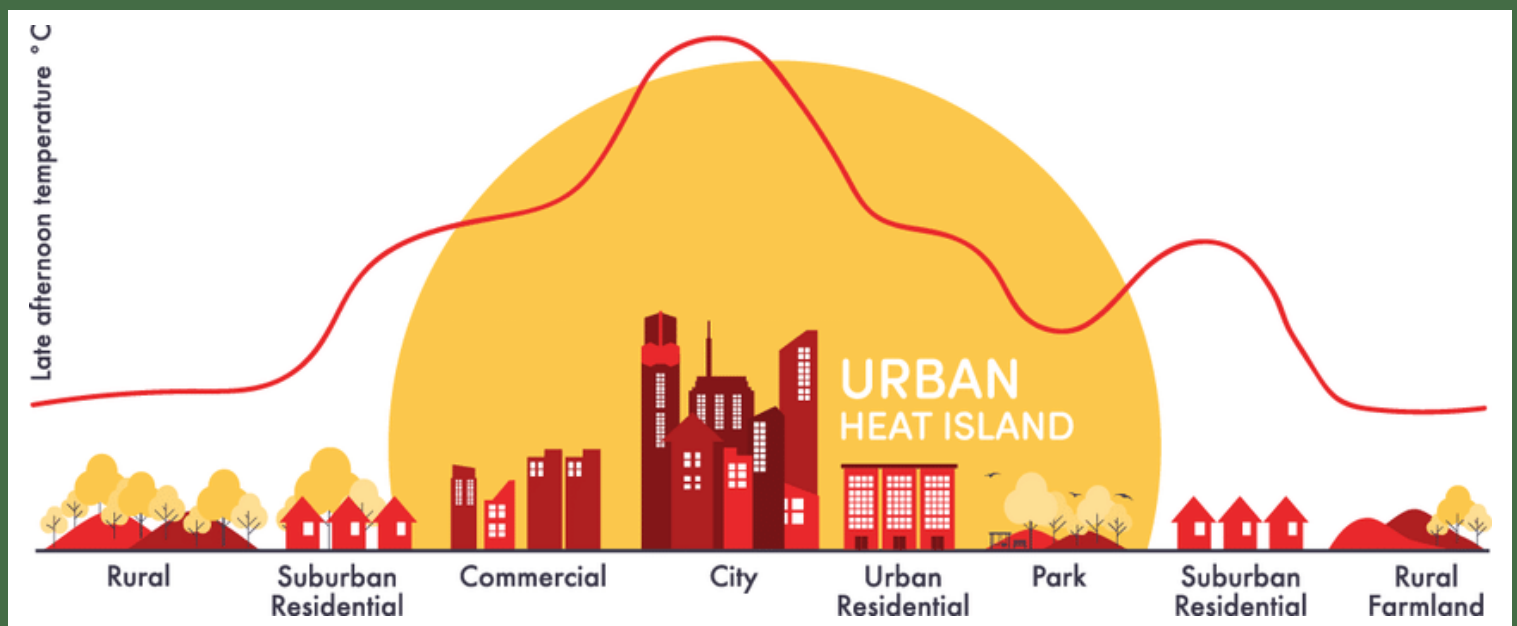


Figure 1.1: The intensity of the heat island across different landscapes. In cities, late afternoon temperatures are higher than in their rural and suburban counterparts (Figure by Kamyar Fuladlu, via World Meteorological Organization).

lesson plan into their science curriculum. The USDA will inspect funded rooftop gardens annually (Schiff 2023).

1.3 Background of the Environmental Problem

Climate change and growing urbanization alter natural processes. Green spaces are replaced with impervious surfaces and dark, heat-absorbing infrastructure. The urban infrastructure exacerbates climate-related issues, such as extreme heat waves and precipitation events. When heat is trapped in these surfaces, the surrounding temperatures become much hotter, leading to increased risks of heat-related illnesses for city residents. In addition, during high rainfall, water cannot penetrate the non-porous pavements causing runoff. The stormwater runoff overwhelms sewage and drainage systems that are not equipped to handle large amounts of water, which can lead to flooding, infrastructure damage, and sewage water

entering nearby bodies of water. As climate change intensifies, more issues will arise in cities already overburdened with environmental issues, such as extreme heat, poor air quality, and intense rainfall. If trends continue, these problems will not only continue to harm the environment but also the communities living in areas that lack the infrastructure to mitigate the destruction.

1.3.1 Urban Heat Island Effect

The urban heat island effect (UHIE) is a phenomenon that causes the temperature to be higher in urban areas than in their surrounding areas, which can lead to a myriad of problems for urban environments and residents. The New York City Prospect Park and Inwood Hill Park fires are examples of bushfires caused by increased urban temperatures, offering greater context on how UHIE impacts urban natural environments and public spaces. Despite the ongoing problem, numerous studies show green spaces and tree canopies can effectively mitigate the effects of the UHIE, forming the premise of the bill.

Daytime temperatures in urban areas can be as much as 1-7 degrees Fahrenheit hotter than in parks or suburban areas outside the city (NYC Parks 2022). In New York City, more than 6.1 million residents experience temperatures around 9 degrees Fahrenheit hotter than the outlying suburban and rural areas (Climate Central 2023). The UHIE is attributed to the decreased tree cover from 2001 to 2003 by 188,000 hectares, which left only 22% of tree canopy cover today (Global Forest Watch n.d.). The compounding factors of absorption of heat by urban surfaces, the increased greenhouse gas effect, and the lack of tree cover cause these higher surrounding temperatures.

Neighborhoods within cities also can experience an intra-urban heat island effect. Temperatures increase when there is an uneven distribution of land cover, more gray infrastructure, and less greenery to cool the surrounding air (U.S. Environmental Protection Agency 2019). Greenery can cool the air through evapotranspiration, a process similar to human sweating. Areas with tightly compacted buildings with little to no greenery have lower reflectivity, or albedo, compared to heavily vegetated areas. The dark surfaces of urban infrastructure, like concrete and asphalt, absorb most of the sunlight and re-emit heat back into the surrounding environment. Some neighborhoods, like Portland, Oregon, are experiencing temperatures 10 degrees warmer than the entire city because the structures are densely packed and have heat-absorbing structures (Anderson and Bell 2011).

Studies also show that tree canopy is essential for cooling urban surface temperatures. For

example, researchers experimented between 2008 and 2015 to showcase the surface temperature change before and after tree removal in a selected area. The results show that the greatest surface temperature increase is associated with the greatest tree canopy loss, with a peak seasonal increase of 4 °C, representing a 15% increase from the temperature before tree loss (Elmes et al. 2017). Urban green spaces like parks have a similar effect. Large parks with areas of more than 10ha have the highest average cooling effect and intensity, with a 1–2 °C temperature reduction that extends over a 350m distance from the park boundary (Aram et al. 2019). The cooling effect of tree canopy and urban green spaces seems obvious; however, green covers in urban areas are declining.

In October 2024, New York City's Prospect Park and Inwood Hill Park experienced unprecedented bushfires in the driest October on record. The fires destroyed about 2 acres of urban forest and approximately 4 acres of forested land which threatened the safety of nearby residents (Colon, 2024). These catastrophic events raise the issue of droughts and rising temperatures in the public discourse, as local communities prepare for an increase in the frequency and severity of wildfires in the coming years. The fires greatly reduced vegetation which is crucial to mitigate the UHIE in affected communities.

1.3.2 Flooding

Climate change is increasing the frequency and intensity of extreme weather events, such as droughts, precipitation, and hurricanes. According to an EPA report, the average total precipitation

has risen by 0.2 inches per decade since 1901, resulting in a total increase of around 2.4 inches from 1901 to 2024. These precipitation changes are experienced differently across regions of the United States. For instance, in the Northeast (e.g., New York), there has been an increase in total annual precipitation by 10% to 20%, while the Southwest (e.g., Arizona) has experienced a reduction in annual rainfall by 20-30%, exacerbating regional water scarcity. Inconsistent weather patterns like these, contribute to flooding and events such as combined sewer overflows (CSOs), especially in urbanized areas. Combined with the existing state of urbanization, changes in rainfall can have disastrous effects (Wu 2024). Urban surfaces, such as sidewalks, streets, and roads, are not built for extreme precipitation because all these surfaces are impervious. When it rains, water is not able to infiltrate the ground as it would in vegetated landscapes. Instead, there are higher chances of stormwater runoff leading to flooding events.

These flooding events have drastic implications for low-income communities of color that lack the adequate infrastructure, financial means, and resources to deal with them. Discriminatory practices, such as redlining, prevented these communities from buying homes and residing in certain neighborhoods. This meant that they were pushed to congregate in neighborhoods with fewer trees, low-lying areas, and more impervious pavement, which increases the risks of faster-moving stormwater runoff and localized flooding in these areas (Pasche 2024). Another problem faced in these neighborhoods is outdated sewer systems that are not built to handle heavy precipitation events. The combination of these problems has a synergistic effect on one another, impacting underserved

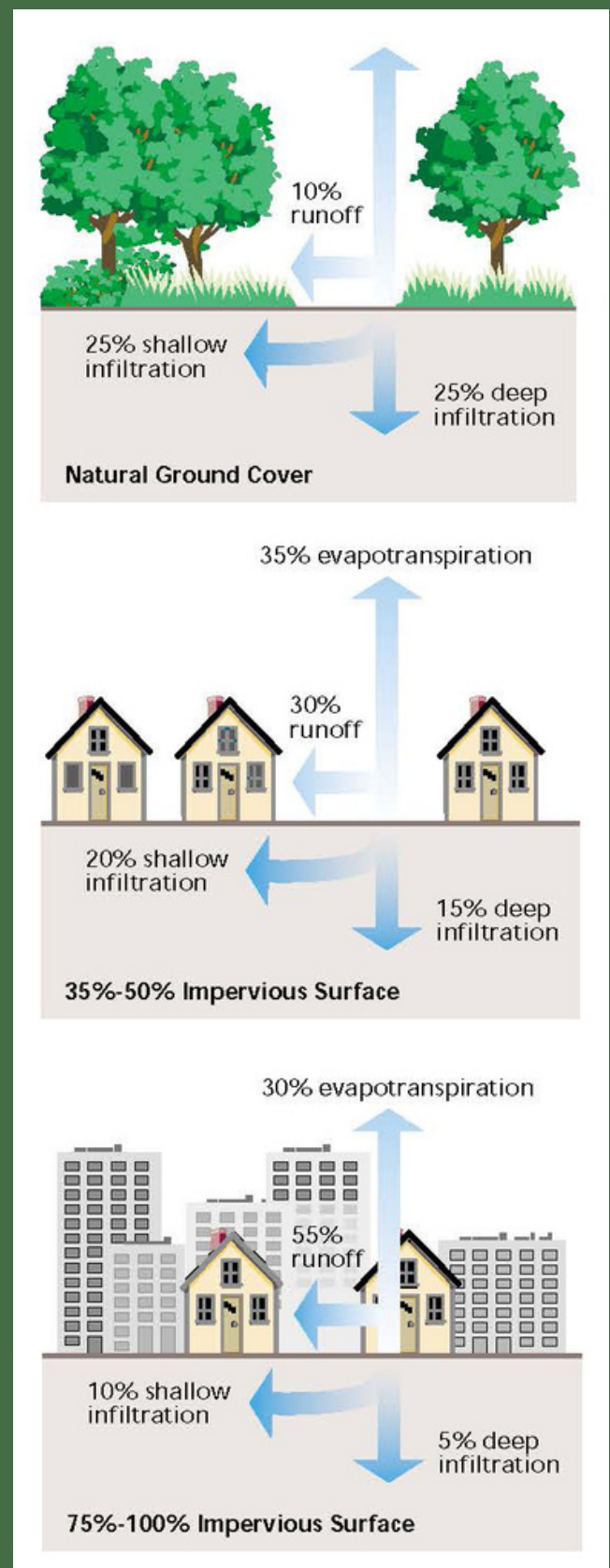


Figure 1.2: Infiltration rates in areas with vegetation and urban areas with impervious surfaces (U.S. Climate Resilience Toolkit 2020)

communities greatly compared to more affluent, white communities that have the built infrastructure and greenery. Implementing green infrastructure can mitigate these effects by absorbing, cooling, and filtering stormwater more effectively than impervious surfaces. A satellite-based study showed that with a 10% increase in green space, 3.8% of total runoff flow and 2.2% of the sudden incidence (“flashiness”) of floods could be reduced (The Nature Conservancy 2022).

1.4 Public Health Impacts

1.4.1 Heat-Related Illnesses

Addressing UHIE is not only an environmental concern but a critical public health priority requiring targeted interventions such as urban reforestation, expanded access to cooling centers, and comprehensive heat action plans.

UHIE, combined with frequent and intense heat waves, poses severe health risks to urban residents (World Health Organization 2024) and places a significant burden on public health systems. A heat index is the temperature that the body feels when relative humidity combines with ambient temperature. Minor heat-related conditions (e.g., fatigue,

weakness) become prevalent at a heat index of 80 degrees Fahrenheit and major heat-related conditions (e.g., heat stroke, death) begin to appear after ambient temperatures exceed 90 degrees Fahrenheit. A higher heat index brings greater discomfort to the human body (US Department of Commerce, n.d.), leading to increased overall health weakness, particularly among older adults, children, and individuals with preexisting health conditions. In Miami, the summer heat index averages 105 degrees Fahrenheit, which poses an extreme risk to the communities living there, especially high-risk individuals (Miami Dade County Office of Resilience 2024).

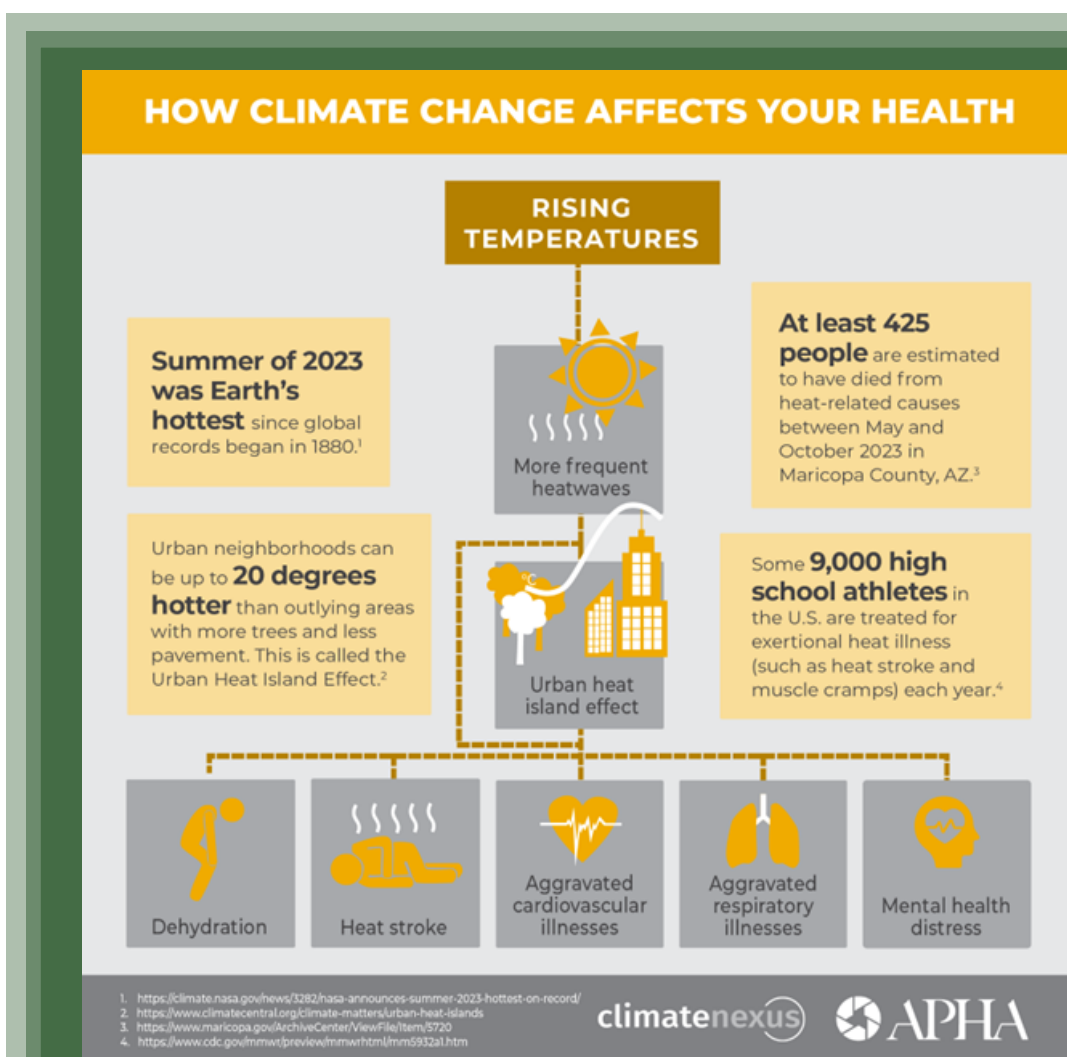


Figure 1.3: Climate change affects your health through a variety of mechanisms (American Public Health Association 2024)

According to a study published in the *Journal of American Medical Association*, the number of heat-related deaths increased from 1069 in 1999 to 2325 in 2023, which represents a 117% increase (Howard et al. 2024, 1203). These illnesses not only result in immediate health emergencies but also exacerbate long-term health disparities, as vulnerable populations such as low-income households and marginalized communities often lack adequate resources to mitigate these risks. The consequences of high temperatures are far worse for those who do not have access to air conditioning or green spaces. Public health agencies report a strain on healthcare infrastructure caused by extreme heat as emergency rooms in urban areas experience higher admission rates for heat-related conditions (e.g., dehydration, heat stroke, etc.) during prolonged heat waves (American Public Health Association 2024). The lack of vegetation worsens these conditions by preventing access to shade from trees and cooler surrounding air (New York State Division of Lands and Forests, n.d.).

1.4.2 Asthma

Asthma remains a significant public health burden in disadvantaged urban areas, driven by environmental and socio-economic factors. The South Bronx exemplifies this problem, with asthma hospitalization rates among the highest in New York City—70.4 per 10,000 children compared to a citywide rate of 22.9 per 10,000 (Gamarro 2020). This disparity stems from multiple contributors: extreme heat exacerbates respiratory issues by increasing ground-level ozone and particulate matter, while socio-economic stressors such as inadequate housing and limited healthcare access compound the risk

of severe asthma outcomes.

Air pollution, particularly in urbanized, industrial areas, further intensifies the issue (Estevez 2020). Stationary and mobile sources like factories, landfills, and transportation release pollutants that affect nearby low-income communities (US EPA 2021). While some greenhouse gas emissions have decreased due to regulations, toxic pollutants remain concentrated in these areas. Together, these environmental and social determinants create a synergistic effect, heightening asthma prevalence in vulnerable communities. Addressing these intertwined challenges requires targeted interventions that improve air quality and mitigate socio-economic disparities, promoting better health outcomes in high-risk urban areas.

1.4.3 Food Deserts

Low-income communities across the U.S. increasingly face food insecurity, often residing in "food deserts"—areas where accessing fresh, healthy food requires more than a mile of travel, usually by car. These areas, also known as low-income, low-access (LILA) zones, primarily offer highly processed, low-nutrient foods, contributing to health risks like diabetes and obesity. Approximately 12.7% of U.S. census tracts fall into this category (Martin 2024).

Food insecurity is further exacerbated by inflation, rising food prices, and extreme weather events (Binkovitz 2017). For example, after Hurricane Harvey in 2017, many Houston residents were left without access to food or water as floods destroyed homes, vehicles, and grocery stores. As extreme weather patterns become more frequent, urban food deserts will likely

expand, increasing vulnerability for low-income communities (Clay and Ross 2020).

1.5 Environmental Justice Lens

An environmental justice community is defined as a low-income community, primarily composed of people of color, that faces higher burdens of environmental hazards due to continued disinvestment and disproportionately living near industrial and waste sites (California Environmental Justice Alliance 2016). In the 1930s, the federal government created a racially explicit policy designed to segregate people of color, predominantly Black people, from white neighborhoods (Mark Lopez 2019). Also known as redlining, Black neighborhoods were outlined in red on a map and graded based on how risky they were for investment, while white neighborhoods were outlined in green as “best” for investments (Mark Lopez 2019). These discriminatory practices made it impossible for Black Americans to receive loans for housing and limited their housing options, leading to overcrowded housing. Furthermore, disinvestment made neighborhoods more attractive for new development projects, like highways and polluting industries, to build on cheaper lands. Redlining is deeply embedded in American cities. Many of the historically redlined areas are the most likely to have densely populated and dark infrastructure, lack of vegetation, and higher levels of pollutants. and more environmental-related issues (Zhong and Popovich 2022). Policy practitioners and decision-makers have only recently regarded the racist urban planning history as an environmental justice issue, but these communities still lack the

financial resources or capacities to develop green infrastructure that would alleviate many of the issues they face. Re-investment in these environmental justice communities, which the bill seeks to do, is important to rewrite unconstitutional housing practices and ensure future longevity and equity for these communities.

1.6 Issue and Political Analysis

This partisan bill is supported exclusively by Democratic representatives. It is driven by broader political tensions over climate change legislation in the US, with particular concerns about economic costs and regulatory burdens that can affect businesses like fossil fuel companies.

In 2022, President Joe Biden signed the Inflation Reduction Act into law, the largest investment in climate policy in U.S. history. The almost \$300 billion act created tax incentives, grants, and loan guarantees and promoted clean energy. Democratic representatives advocate for environmental justice in their climate policies and promise to maintain the Paris Agreement. On the other hand, Republicans seek to reverse the efforts of climate initiatives, such as withdrawing from the Paris Agreement and deregulating environmental protections.

Republicans could support this bill through advertising job creation necessary for urban green infrastructure projects. Residents would support the bill for local legislation for their improved living conditions, local decision-making power, and employment opportunities. In the

CASE STUDY

HOUSTON, TEXAS

AN ENVIRONMENTAL JUSTICE PERSPECTIVE

Many neighborhoods of Houston are vulnerable to environmental hazards and potential injustices as a result of historic redlining and other restrictive practices. The Northshore neighborhood, for example, is home to a major freeway interchange, several chemical plants, and a nearby landfill, creating a multitude of public health risks for local neighbors (Team XQ 2024b). This community is vulnerable to increased risk of throat, lung, and laryngeal cancers as a result of high levels of particulate matter (PM 2.5) and sulfate (SO₂) in the air from nearby industries (D'Souza et al., n.d.).

Moreover, socioeconomic background plays a role in which communities face the highest risk. Northshore and surrounding neighborhoods are largely populated by a Latino community (over 70% of residents across census blocks) and according to the Climate and Economic Justice Screening Tool (CEJST), the adjusted gross income across the neighborhood is above the 50th percentile, making it a low-income community (White House Council of Environmental Quality n.d.).

Students and faculty at Furr High School in Northshore actively sought to pursue environmental justice efforts in their community. Using grant funding secured from nonprofit and private sources, including a \$10 million grant from XQ (an education innovation initiative) and \$20,000 from the National Recreation and Park Association, the Furr community established a community garden using a half-acre plot of land from the adjacent park in 2016 (Team XQ 2024a). The garden included over 100 fruit trees and multiple plots for growing fruits and vegetables, meeting the needs of local community members. Furthermore, Furr High School had developed a curriculum of four classes for its students to teach them how to cultivate plants and manage local wildlife. Within the first year of curriculum implementation, the school taught 500 students about urban agriculture using the community garden (Team XQ 2024b).

While not situated on a rooftop, leveraging a school community effort to plant a garden and incorporate it within the curriculum can be beneficial for the local community and environment, but also in cultivating future environmental stewardship. The implementation of the pilot program enshrined within the Climate Change Relief for Urban Areas Act of 2023, especially with consideration to applicants with low garden equity scores, can replicate the benefits the Northshore community secured in other environmental justice communities. ■



Furr Students Learning Agriculture at a Community Garden (Houston Chronicle)

meantime, some of the low-income communities demand immediate financial support. There are also practical challenges, for example, the lack of data in most low-income communities.

A bill similar to the Climate Change Relief for Urban Areas Act of 2023 (HR.2786) was introduced by Democratic representative Nydia Velazquez and is titled the Public School Green Rooftop Program. This is a Democratic partisan bill introduced in the House in 2020 and aims to create a grant program for the implementation of green roofs on public elementary and secondary schools (Velazquez 2020). Unlike HR.2786, however, it is to be implemented by the Department of Energy (DOE). Unfortunately, since

its introduction in 2020, the bill has not progressed despite being introduced year after year. The reason behind this is that it is a partisan bill that is introduced in the Department of Energy, whose focus has been mostly on legislation dealing with oil pipelines and the utility grid.

1.7 Current Work

At the federal level, the US Department of Agriculture (USDA) conducts much of the work on urban agriculture and green infrastructure. Section 2 of the bill calls upon a modified approach to work done in the Urban and Community Forestry program conducted by the



Young adults farming at Grow Dat Farm in New Orleans. The farm was awarded a grant by the Urban Agriculture and Innovative Production. (Image by Kirsten Strough of the USDA, via Flickr)

US Forest Service, while urban agriculture work is funded through the Office of Urban Agriculture and Innovative Production. Meanwhile, national nonprofits such as American Forests have taken the lead in both advocating for stronger federal efforts and delivering services to communities.

The Urban and Community Forestry program focuses specifically on developing and maintaining urban forests, a crucial initiative for increasing green spaces in cities. After receiving \$1.5 billion in Inflation Reduction Act funding in 2022, the program awarded nearly \$1 billion to 400 entities throughout the country. Furthermore, the program is an established Justice40 program and ensures that 100% of its benefits are allocated to disadvantaged communities (US Forest Service n.d.). The program has funded a variety of initiatives and projects that support the expansion of publicly available forest data, improvement of education and outreach to decision-makers, and installment of community gardens for food access. Furthermore, the UCF program has also prioritized the advancement of environmental justice through workforce training and promoting community volunteerism (US Forest Service 2021). The UCF program is dedicated to improving urban areas and connecting them with much-needed benefits associated with green spaces.

The Office of Urban Agriculture and Innovative Production (OUAIP) is a division within the USDA's Natural Resource Conservation Service that promotes innovative agricultural practices within urban environments. The OUAIP, created by the Farm Bill in 2018, has created federally funded grants to support the planning and implementation of various agricultural and nature-based solutions

throughout the country. Since 2020, the OUIAP has invested \$40.5 million into local communities with a priority to increase urban agricultural production and improve food access. Furthermore, the office has created the Federal Advisory Committee for Urban Agriculture and Innovative Production to advise and guide the Secretary of Agriculture on policies and programs relevant to addressing barriers to efficient agricultural production within urban regions (USDAb n.d).

Outside of federal agencies, American Forests works on a range of projects to plant trees in underserved urban areas, partnering with local governments, non-profits, and policymakers to prioritize tree planting in regions most vulnerable to the adverse effects of climate change ("Tree Equity - American Forests" 2024). Their impact is already measurable in cities like Phoenix, Arizona, and Providence, Rhode Island, where targeted tree-planting initiatives have reduced heat vulnerability and fostered community resilience and engagement. The Tree Equity Score (TES), developed by American Forests, aligns closely with the goals of the OUAIP and UCF, as it promotes climate resilience and environmental justice. The TES is a pioneering tool to address disparities in urban tree canopy coverage by ensuring equitable access to green spaces for communities across the United States. TES evaluates urban areas based on metrics like population density, income, race, and tree canopy, identifying neighborhoods with the greatest need for trees to enhance air quality, lower urban temperatures, and improve public health (US Forest Service n.d.) to achieve the mission of bringing about tree equity: providing marginalized communities with the same cooling

and health benefits that wealthier neighborhoods enjoy through mature tree coverage.

Federal efforts and learnings from American Forests' TES aligns greatly with the bill's goals to support urban communities facing climate-related challenges, particularly those susceptible to extreme heat. The TES framework could serve as a model and tool to help implement the Act's objectives of establishing a Garden Equity Score (GES) tool, ensuring that federal funds are allocated effectively to promote climate justice and environmental equity.

1.8 Conclusion

The Climate Change Relief for Urban Areas Act of 2023 represents a significant step towards

addressing the pressing environmental challenges faced by environmental justice communities. By prioritizing the urban greening initiatives, the bill aims to lower urban temperatures and enhance overall community resilience. The proposed legislation recognizes the disproportionate impact of climate change on low-income communities and communities of color, seeking to rectify historical inequities through targeted investments in green infrastructure. While the bill faces potential political hurdles, its alignment with existing federal programs and successful community-led initiatives demonstrates its potential to create meaningful change. Ultimately, the Act's focus on environmental justice and climate adaptation offers a promising pathway to create more equitable and sustainable urban environments for all residents. ■



CASE STUDY

PHILADELPHIA, PENNSYLVANIA

HEAT VULNERABLE NEIGHBORHOODS

Communities in Hunting Park, a neighborhood in Philadelphia, have faced disproportionate impacts from environmental threats due to historical redlining and a lack of green infrastructure. Hunting Park is the city's hottest area and experiences significant health challenges among its predominantly Black and Latino population. The limited tree canopy and predominance of the neighborhood of impervious surfaces contribute to the intensification of the urban heat island effect (ACSA 2024), which can aggravate pre-existing respiratory diseases and heat-related disorders in Hunting Park.

Socioeconomic factors further compound the community's vulnerability. Hunting Park's median household income falls well below the city average, and many residents lack access to air conditioning, heightening health risks during extreme heat events. The Climate and Economic Justice Screening Tool (CEJST), which assesses climate change and economic justice intersection, places Hunting Park in the top percentile for surface temperatures and environmental burdens while ranking it low for access to cooling infrastructure and green spaces (MENA Report 2022).

Recognizing these critical challenges, residents and organizations have mobilized to address the UHI. In 2018, the nonprofit TreePhilly partnered with city planners and the Pennsylvania Horticultural Society to launch a tree-planting initiative targeting areas with the greatest need. These organizations planted more than 1,000 trees over three years, significantly increasing the

neighborhood's tree canopy and providing much-needed shade (TreePhilly 2024).

Additionally, Esperanza Academy Charter School, located in the vicinity, integrated green infrastructure into its curriculum by establishing a community garden and outdoor classroom. The Pennsylvania Department of Environmental Protection and regional foundations provided funding to establish learning areas in schools where students could investigate how green infrastructure may reduce urban heat and enhance air quality. Over two years, more than 400 children engaged in environmental education programs, cultivating a culture of community responsibility.

This case study shows how green infrastructure and community-driven initiatives can significantly lessen the effects of UHI. The neighborhood has lowered heat-related risks and built resilience by combining environmental action, education, and outreach (MENA Report 2022). The goals of the Climate Change Relief for Urban Areas Act of 2023, which gives priority to funding for communities with poor garden equity scores to replicate similar activities, are in line with these efforts. For environmental justice communities around the country, Hunting Park serves as an example of how community involvement and engagement from decision makers can overcome local environmental problems. ■



Section 2

Program Implementation



2.1 Introduction

Implementing the Climate Change Relief for Urban Areas Act of 2023 requires two programs to be implemented - one for urban forestry and the other for school rooftop gardens. However, with reasons ranging from significant funding invested in urban forestry to the novelty of working on school rooftops, our team chose to prioritize the pilot grant program and Garden Equity Score as mandated by Section 3 of the bill. The GES serves as the primary guideline to determine

priority amongst potential grant applications and developing the metric requires approaches from multiple lenses, including economic, health, and environmental. After determining program outcomes using these approaches, our team conceptualized a program to implement Section 3, which will involve using the first year to develop the GES and the Request for Proposals (RFP) process before grantmaking in future program years. Our team has determined staff and consultants to hire to supplement the work

of existing USDA staff and a non-grantmaking budget for the first year. In implementing the SPROUT program, our team hopes to see significant outreach to schools, reduced surface temperatures, and other improved environmental outcomes for schools and the communities surrounding them.

2.2 Section 3 Focus

While the bill is trying to increase both urban greening and school rooftop gardens in U.S. cities, our team seeks to prioritize Section 3 of the bill, focusing on the pilot school rooftop grant program and GES. While urban forestry is a critical issue and green infrastructure is a solution to many environmental justice concerns in communities, there is already a significant amount of federal funding and programs that support urban forestry efforts. The Urban and Community Forestry Program, the federal government's primary program for urban forestry and the program supported by Section 2 of the

bill, received \$1.5 billion in funding for fiscal years 2023-2028 as part of the Inflation Reduction Act passed in 2022. Other programs in the IRA by NOAA, EPA, and other agencies also cover urban forestry as eligible activities, which shows how invested the federal government is towards the effort. Meanwhile, school rooftop gardens are a novel policy solution that has yet to be institutionally implemented by the federal government. The GES would be the first of its kind to measure how socioeconomic and health factors relate to garden access and how communities could potentially benefit from access to gardens. Furthermore, the pilot program would primarily serve school-aged children, who are one of the most vulnerable populations to urban environmental problems. Ultimately, investing in efforts targeted towards children, through gardens or through an accompanying science curriculum, would promote a strong sense of environmental stewardship which can spur further community action beyond the program



An example of an urban rooftop garden
"Citrix Raleigh - Rooftop Garden," Citrix Raleigh, CC BY-ND 2.0, via Flickr

2.3 Considerations for the Program Design

The bill mandates the development of the Garden Equity Score but leaves the methodologies for the creation of the GES tool to the discretion of the United States Department of Agriculture (USDA). The bill does not explicitly state environmental justice communities as the target areas; however, it mandates the inclusion of certain information, such as location, density, and racial composition, which has been used in other tools, such as CEJST, to identify environmental justice communities. However, to accurately assess equity, our team considered three approaches:

- **Economic Burden Approach:**
Prioritizes environmental justice communities burdened with the highest economic costs.
- **Human Health Approach:**
Prioritizes environmental justice communities with the highest rates of heat-related illnesses, respiratory issues, and diet-related conditions
- **Environmental Impact Approach:**
Prioritizes environmental justice communities with the highest surface temperatures and levels of soil, air, and water pollution.

2.3.1 Economic Burden Approach

The Economic Burden Approach draws specific attention to environmental justice communities with the highest economic burdens due to increased surface temperatures, respiratory

illness, and lack of food sovereignty. Focusing the GES tool on cost burdens and implementation of green infrastructure will lower the portion of income going towards necessities, like energy usage and hospital costs.

Economic Burden Approach

Potential Indicators

- Cost of energy
- Cost of a nutritious diet
- Cost of hospitalization due to respiratory or heat illness

Relevant Agencies and Experts:

- US Department of Energy
- White House Council on Environmental Quality
- USDA Economic Research Service

While focusing on this approach has benefits, it may not be feasible because it is hard to quantify the cost of a burden fully. Also, using certain cost indicators, like hospitalization costs, would be difficult due to insufficient data.

2.3.2 Human Health Approach

The Human Health Approach prioritizes environmental justice communities with the highest health burdens due to climate and land use in the urban environment. Focusing the GES tool on health burdens would benefit communities by framing solutions around public health, which can reduce the prevalence rate of health issues. Another benefit to this approach is that extensive research has already been done to highlight community health outcomes.

Human Health Approach

Potential Indicators

- Number of reported emergency visits due to heat stroke
- Number of asthma cases
- Number of people without access to nutritious foods

Relevant Agencies and Experts:

- Centers for Disease Control and Prevention
- US Department of Housing and Urban Development
- Federal Emergency Management Agency
- US Department of Transportation
- Community health organizations

Despite this approach's focus on health inequalities that environmental justice communities face, there is a lack of research that fully assesses the intersectionality between community health and nature. Also, this approach does not consider other factors that might contribute to the quality of health, such as access to adequate healthcare or individual human actions.

2.3.3 Environmental Impact Approach

The Environmental Impact Approach focuses on environmental justice communities with the highest environmental burdens, such as the highest surface temperature and pollution levels. Focusing the GES tool on environmental burdens directly addresses the bill's primary goal: decreasing surface temperature. It also

prioritizes communities dealing with severe flooding due to high rainfall events by using green infrastructure to mitigate floods and CSO events and reducing infrastructure damage.

Environmental Impact Approach

Potential Indicators

- Surface temperature
- Level of water and soil pollution
- Flooding frequency pertaining to rainwater management
- Habitat and food availability for pollinators

Relevant Agencies and Experts:

- US Fish and Wildlife Services
- US Geological Survey
- National Oceanic and Atmospheric Administration
- Centers for Disease Control and Prevention

While this approach may improve conditions for environmental justice communities overburdened by environmental issues, it potentially overlooks the social impacts that the bill is also trying to address. In addition, there is a lack of research that accurately measures experiential heat. This heat is influenced by factors like asphalt, cement, humidity, lack of tree shade, and cooling, which causes higher perceived temperatures for communities in urban heat islands.

2.3.4 Program Design Choice

In assessing the three approaches, our team found that the best approach to designing an

implementation program was a combination of the three – one encompassing all aspects of the environmental justice issue. The GES should emphasize key metrics such as surface temperature, incidence of respiratory illness, and local food access and cost, but also allow some weight to address many of the other factors covered by each of the three approaches. Additionally, priority for these metrics should be determined in consultation with scientific expertise and public stakeholders, emphasizing the need for their input in the program implementation plan. Applying a holistic understanding of the socioeconomic and environmental factors affecting communities through the GES and grant program is critical for the successful implementation of the bill.

2.4 SPROUT Program Design

Our team has designed a program titled Schools Promoting Opportunities for Urban Transformation (SPROUT) for the bill's implementation. This program will be administered by the OUAIP to implement the pilot grant program for public elementary and secondary school rooftop gardens, as detailed in Section 3. The main goal of this program design is to reduce surface temperatures, reduce the cost of energy, and increase environmental stewardship at an early age. The program will be funded using the \$30 million in appropriations per fiscal year from 2023 to 2028.

Over the first year, the implementation of this program is divided into two main tasks. The first task is the development and launch of the Garden Equity Score. Staff on the project will



develop the GES using the following metrics in accordance with the bill:

- The area in which the eligible entity is located
- Population density
- Racial composition
- Number of urban gardens
- Incidence of respiratory illness
- Food sovereignty
- Average surface temperatures

While the GES team develops the GES tool and accompanying website, another team will be working on the second task for this first year: the Request for Proposals (RFP) development and launch. This will start three months after the beginning of the program and includes tasks such as developing the language of the proposal as well as departmental and legal review. This task also includes creating and launching the application portal for the RFP.

In the first year of the program design, the team will not review any grant applications nor disburse any grant funds. This decision is because developing the GES tool and the RFP will take approximately one year and 9 months, respectively, to complete. By focusing the first year on establishing the program's foundation, we can build a robust program that will have the tools and structures necessary to award grants efficiently and equitably in the future.

Because of the novelty of the SPROUT program, there are many potential drawbacks to consider during implementation. Any work done in the future to receive and start processing grant applications is contingent on developing these two tools within the first year. Any delay experienced in this creation process can delay the rooftop gardens grant distribution process. The bill appropriates a maximum of 30 million dollars per fiscal year over 5 years for this program design. However, there is no guarantee that the full amount of money will be granted. In addition to that, it is difficult to estimate how many grants OUIAP will be able to allocate; the amount of money needed to build the rooftop garden will be specific to each grantee and depends on the amount of work required for that space. The last potential drawback of this program is that it may not be able to reach those who are the most in need of the rooftop garden. Before any school can start building the rooftop garden, they must perform a site assessment. That site assessment will inform the building's ability to receive a rooftop garden and whether or not it is safe. Unfortunately, that means that if a school does not meet the safety standards as well as the implementation criteria, they will not be able to have the rooftop garden. Moreover, if a school does not have extensive grant writing capacity, they are less likely to be able to submit a successful grant application.

2.5 Program Logistics

2.5.1 Staffing and Tasks

Successful implementation of any federal grant program requires a coordinated staff, a sufficient and well-planned budget, and a feasible timeline

to carry out the work. SPROUT will leverage a combination of existing staff at the OUAIP and, in its first year, will hire several consultants to set the foundations of the program by developing the GES and initial RFP. The absence of grantmaking in the first year allows for more funds to be leveraged in supporting staff and program planning activities. The two core tasks of developing the GES and drafting the RFP are expected to be completed within one year so that future program years have a strong foundation for grantmaking and local implementation.

Staffing forms a critical component towards successfully implementing SPROUT. We will be leveraging staff from the Office of Urban Agriculture and Innovative Production as we find that this office within USDA is the most well-equipped to carry out the program. The OUAIP is composed of the following individuals:

- Director
- Program Manager
- Urban Agriculture Specialist
- Management and Program Analyst (UAIFAC)
- Management and Program Analyst (Grants and Agreements)
- Management and Program Analyst (CFWR)
- Management and Program Analyst (UAIP)

The Program Manager of the OUAIP will be responsible for hiring the required staff before the beginning of the year on January 1st. The current program manager of the OUAIP will hire appropriate personnel for the task force, starting with a newly formed Task Lead Developer role, which is a new and permanent position. The rest of the newly created task force will directly report to the Task Lead Developer. The Task



the respective tasks concerning the two main tasks of developing and launching a GES and RFP platform (For a graphic of these roles, please see Appendix A).

The development and launch of the GES is projected to take an entire year to complete. At the beginning of the first quarter (Q1) of the year, the program manager will set the respective goals for the development of the GES. For the

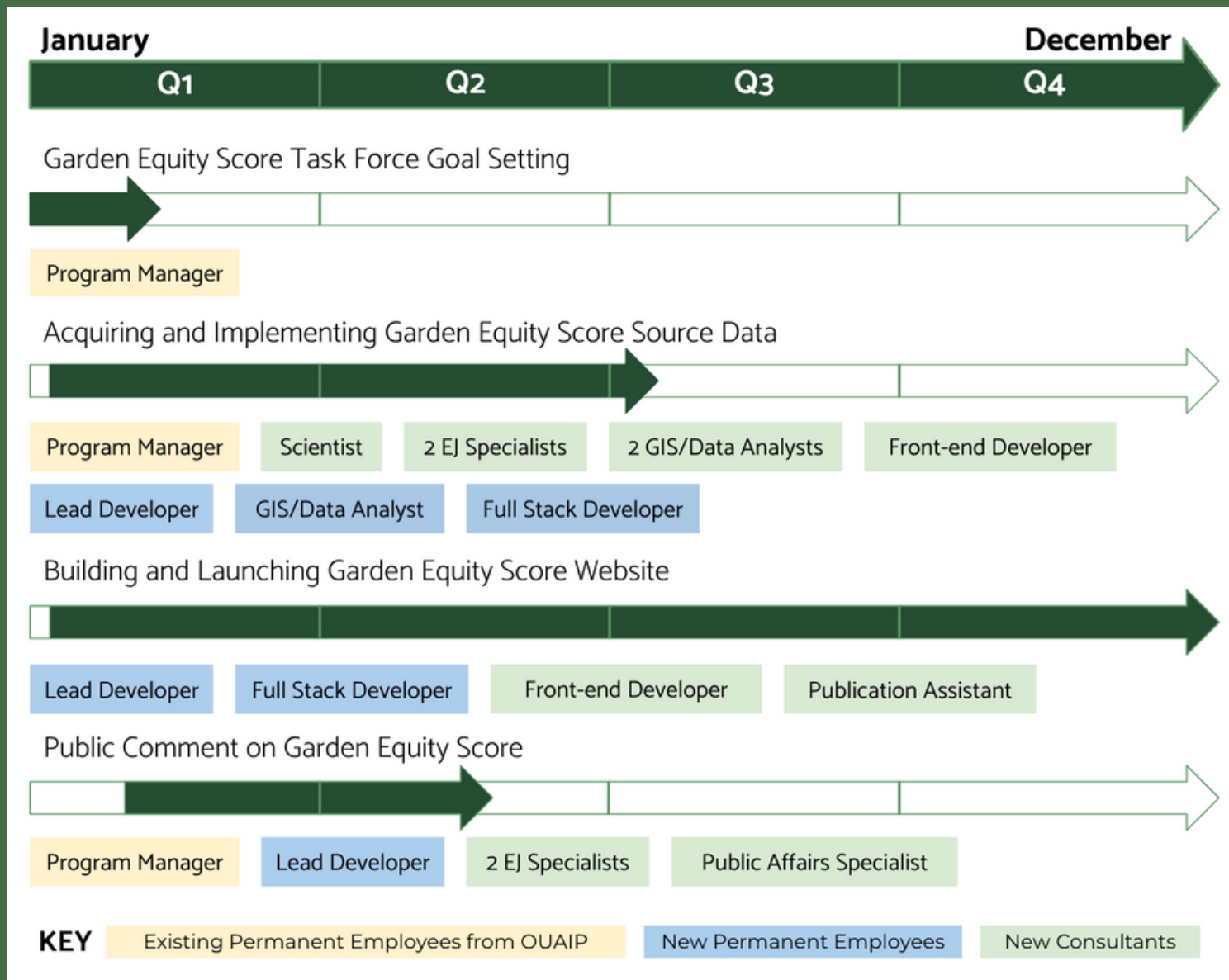
Lead Developer will report to the Program Manager of the OUAIP. Within the remaining task force, the new consultants will consist of a scientist, two environmental justice specialists, two GIS/Data Analysts, a front-end developer, a publication assistant, and a public affairs specialist. The consultants' position will not continue past Q4. The new permanent full-time equivalent (FTE) employees will consist of a Lead Developer, a GIS/Data Analyst, and a full-stack developer. The existing staff of the OUAIP consists of seven federal employees. The new task force contains 11 employees, a combination of consultants in full-time positions. In total, 18 staff members will be responsible for carrying out

remainder of Q1 and Q2, the team will focus primarily on acquiring and implementing the GES Source Data. The program manager, scientist, two environmental justice specialists, two GIS/Data Analysts, frontend developer, lead developer, and full stack developer will be responsible for completing this task.

Simultaneously, the lead, full-stack, and front-end developers will build the GES website, and the publication assistant will create materials explaining the methodology behind GES for the website. A public comment session over Q1 and Q2 will allow the task force to implement feedback from the environmental justice

TIMELINE FOR IMPLEMENTATION

GARDEN EQUITY SCORE



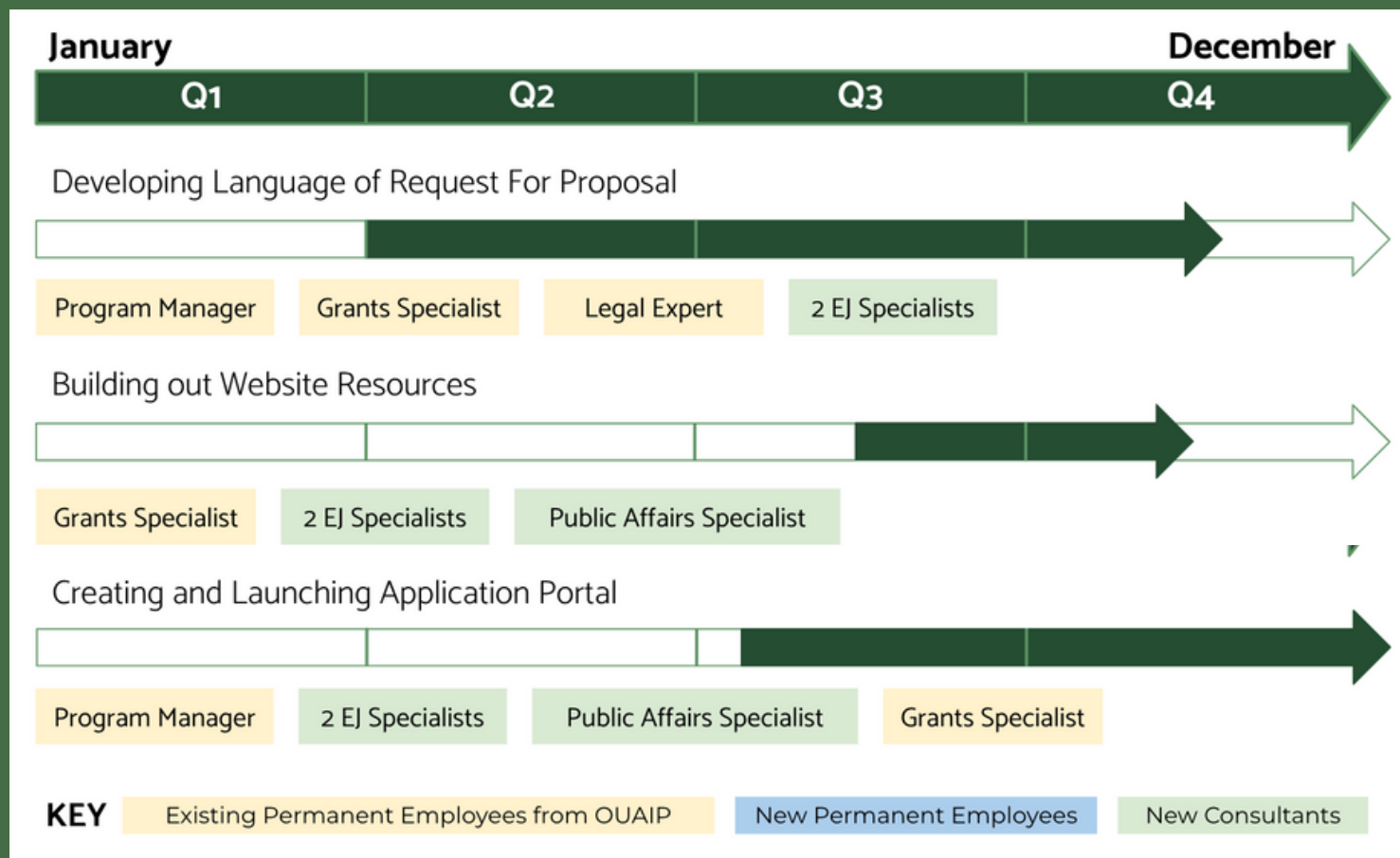
communities the bill strives to reach. The program manager, lead developer, environmental justice specialists, and public affairs specialists will manage the public comment process.

The second main task of developing the RFP will begin in Q2 and end in Q4. The OUAIP's existing personnel will be the primary personnel involved in

the development and launch of the RFP. The program manager, OUAIP grants specialist, legal expert, and environmental justice specialists will develop the language of the RFP and ensure that it meets the bill's mandates. In Q3 and Q4, the grants specialist, environmental justice specialists, and public affairs specialists build out website resources, including materials advising

TIMELINE FOR IMPLEMENTATION

REQUEST FOR PROPOSAL



applicants on how to apply. Lastly, the RFP portal will be created and launched by the program manager, environmental justice specialists, the public affairs specialist, and the grants specialist. In leveraging the existing OUAIP structures, the office and additional task force will ensure the successful implementation of the act's objectives.

2.5.2 Budget

The budget for SPROUT is composed of two major expense categories - personnel costs and other-than-personnel-services (OTPS) costs. The

SPROUT program will actively pursue the full \$30 million appropriated annually during the years grants are allocated; however, during the first year, the full amount will not be necessary. The year 1 budget totals between \$1,320,050 and \$1,425,050.

Personnel costs fund the salaries and fringe benefits of the new permanent staff on the SPROUT project. The key team members include the Task Lead Developer, Full Stack Developer, and GIS/Data Analysts. The RFP process utilizes the expertise and experience of existing board

TABLE 1: PERSONNEL COSTS

TYPE	POSITION	TIME (YEAR)	EXPECTED PAY
New Permanent Employees	Task Lead Developer	1	\$100,000-\$120,000
	Backend/Full Stack Developer	0.75	\$75,000-\$90,000
	GIS Developers/Data Analyst	1	\$117,000
Existing Employees	Program Manager	1	\$10,000 raise
	Educational Expert	0.5	N/A
	Grants Management Specialist	0.5	N/A
	OUAIP Personnel	0.5	N/A
TOTAL: \$293,000-\$338,000			

members within the USDA Office of Urban Agricultural and Innovation Production to design and launch the RFP process to minimize expenses. The staff includes the UI/UX Engineer, Environmental Justice Specialists, Scientists, and others critical to public engagement and data accuracy. Therefore, as shown in Table 1, the total personnel cost is approximately \$293,000-\$338,000.

The OTPS expenses include consultant fees, software and hardware procurement, infrastructure maintenance, and miscellaneous expenses, except personnel salaries such as equipment, supplies, utilities, and contractual services. The program manager will hire nine consultants, costing approximately \$843,000-\$903,000 per year. The hardware and software facilities account for a large part of the expenses, making up the remaining 20%. The budget also needs to take into account expenses for transportation and travel. Therefore, as

shown in Table 2, the total operational cost is about \$967,100-\$1,007,100.

The total staffing and operational costs total \$1,320,050-\$1,425,050. The estimated \$1,425,050 is significantly less than the appropriated \$30 million, as grant funds will not be allocated in the first year. However, this is necessary, as the focus of the hired team must prioritize the creation of a robust program design to support grant allocations in future years. The strong foundation will result in efficient and effective grant allocation for applicants who apply in the second year.

2.6 Measures of Success

The program’s first year is defined by the creation and launching of the Garden Equity Score (GES) tool and Request for Proposal (RFP) application portal. These initiatives align with the legislative mandates to improve climate resilience

TABLE 2: OTHER THAN PERSONNEL COSTS

TYPE	ITEM	QUANTITY	TIME (YEAR)	EXPECTED COST
Consultants	Environmental Justice Specialists	2	1	\$200,000-\$240,000
	Publications Assistants	2	1	\$140,000
	GIS Developers (Contract)	2	1	\$234,000
	Public Affairs Specialist	1	1	\$70,000
	UI/UX Frontend Engineer	1	1	\$100,000-\$120,000
	Scientist	1	1	\$99,000
Technology and Software	JIRA Team and Workflow Management	1	By Month	Free
	SQL and Python licenses	3	-	Free
	Data Visualization Tools (Tableau)	3	By Year	\$3,900
	GIS Software (ArcGIS, QGIS)	4	By Year	\$7,500
Hardware and Infrastructure	Computers	5	One-time	\$8,500
	Dedicated Server	1	By Year	\$13,800
	Database	1	By Year	\$10,000
Miscellaneous Expenses	Transportation	3	By Year	\$7,200
	Travel*	6	Average	\$12,000**
	WiFi and devices for UI/UX Engineer	1	By Year	\$1,200

TOTAL: \$967,100-\$1,007,100

in environmental justice communities and address urban heating and surface temperature challenges. These efforts are part of broader infrastructure goals outlined in the bill, which aims to increase tree canopy and build green infrastructures like rooftop gardens and urban forestry to mitigate the effects of global warming.

The success of the program will be measured across three performance metrics.

2.6.1 Input Measures

Measuring the performance of inputs to the program ensures SPROUT maximizes resources and completes both tasks in a timely manner.

INPUT MEASURE OF SUCCESS: STAFFING

Objective:

The necessary staffing—both pulled from existing OUAIP staff and new hires—is hired by the Program Manager.

Metric:

Number of staff fully onboarded by the end of Week Two.

Responsible Person:

Program Manager

INPUT MEASURE OF SUCCESS: OTPS BUDGETING

Objective:

The SPROUT team complies with the budget, identifying potential opportunities to save costs.

Metric:

Monthly reports sent to the USDA budget office.

Responsible Person:

Program Manager, reporting to USDA budget office

INPUT MEASURE OF SUCCESS: PUBLIC COMMENT

Objective:

The SPROUT team conducts outreach for environmental justice members and schools. The Program Manager and Lead Developer review feedback relating to the GES tool.

Metrics:

Number of schools that participated in the public comment.

All feedback is read and discussed.

Responsible Person:

Program Manager

2.6.2 Output Measures

Metrics surrounding the outputs of the program enable SPROUT to track the progress of relevant

tasks. If the metrics demonstrate the team is not on track to complete objectives by the end of the first year, the team should adjust workflows.

OUTPUT MEASURE OF SUCCESS: GES TOOL LAUNCH

Objective:

To launch a user-friendly, reliable GES website that effectively identifies schools most in need of rooftop garden projects based on equitable mapping criteria by the end of the first year.

Metrics:

- A low number of reported technical bugs or data inaccuracies related to the garden equity scores.
- User engagement metrics, including the number of schools accessing the tool and completing equity assessments.
- Positive feedback from pilot users regarding ease of navigation and effectiveness in school identification.

Responsible Person:

Task Lead Developer

OUTPUT MEASURE OF SUCCESS: RFP LAUNCH

Objective:

The SPROUT team launches the RFP website by the end of the first year and effectively socializes the grant.

Metrics:

- A low number of reported technical bugs.
- User satisfaction score from post-application surveys.
- Number of schools reached through targeted outreach efforts (target: 80% of eligible schools in priority neighborhoods).

Responsible Person:

Grants Management Specialist

OUTPUT MEASURE OF SUCCESS: GES TOOL LAUNCH

Objective:

The SPROUT team develops a GES FAQ page, methodology pages, and application guide and hosts webinars to assist schools in navigating the application process.

Metric:

The number of technical assistance resources developed.
Attendance at webinars.

Responsible Person:

Public Affairs Specialist

2.6.3 Impact Measures

Impact measures provide data-driven evidence of SPROUT's effectiveness, helping the team ensure that the program meets the mandates of

the bill. Furthermore, impact measurement could provide sufficient evidence of success for future budget processes to award full funding to the program.

IMPACT MEASURE OF SUCCESS: SCIENCE CURRICULUM

Objective:

To educate students on urban sustainability practices by integrating practical knowledge about urban agriculture, pollinator habitats, green infrastructure, and/or phytoremediation into their science curriculum. This initiative aims to foster environmental stewardship and scientific literacy through hands-on, real-world applications in rooftop gardens.

Metrics:

Student comprehension of urban agriculture and green infrastructure concepts, assessed through pre- and post-curriculum evaluations.
Teacher and student feedback on curriculum effectiveness and engagement levels.
Further relevant metrics designed by educational expert.

Responsible Person:

Educational Expert

IMPACT MEASURE OF SUCCESS: TEMPERATURE

Objective:

To assess the effectiveness of rooftop gardens in reducing energy use and alleviating temperature fluctuations in classrooms, thereby improving learning environments and supporting sustainable infrastructure in schools identified through the GES tool.

Metrics:

Average temperature reduction in classrooms compared to baseline measurements, aiming for a target reduction of 4.5°C, in line with EPA standards to be collected by third-party auditors.

Correlation between temperature changes and student performance metrics (e.g., attendance, surveys).

Responsible Person:

Program Manager

2.7 Conclusion

The SPROUT program, designed to implement the Climate Change Relief for Urban Areas Act of 2023, focuses on distributing grants for school rooftop gardens prioritized by the Garden Equity Score (GES). In its first year, the program will prioritize creating the GES and establishing a Request for Proposals (RFP) process, leveraging expertise from the USDA's Office of Urban Agriculture and Innovative Production. The GES

will consider economic, health, and environmental factors to ensure equitable grant distribution.

With a budget of \$1.3-1.4 million for the first year, the program aims to reduce surface temperatures, promote energy efficiency, and foster environmental stewardship among students. Success will be measured through input, output, and impact metrics, including the timely development of tools, outreach effectiveness, and environmental improvements in participating schools. ■

CASE STUDY

NEW YORK CITY, NEW YORK

ROOFTOP GARDEN IN NYC PUBLIC SCHOOL 41

PS41, located in the Greenwich Village neighborhood of New York City, serves as an example of a successful program implementing rooftop gardens in schools. PS41 is a school that welcomes students from kindergarten to fifth grade and has about 800 students. In 2010, through the efforts of a student's mother, they introduced the Greenroof Environmental Literacy Laboratory (GELL) program. This program oversaw the creation of a 9,000-square-foot green roof, which served as a learning laboratory for the students. It aims to enhance environmental literacy, awareness, and stewardship for its students through ecological studies and various science classes such as chemistry and biology ("New York PS41 GELL" n.d.).

According to school officials we interviewed, the implementation of the roof, coupled with other renovations, improved the energy rating of the building, going from a grade C to a grade A. According to the data they collected, school officials observed a 27.08% decrease in the annual amount of energy consumed by the school and a reduction in greenhouse gas emissions ("New York PS41 GELL" n.d.). In addition to these

improvements in energy consumption, the rooftop buffered approximately 180,000 gallons of stormwater annually ("New York PS41 GELL" n.d.). This is significant because extreme weather events, such as intense precipitation or flash floods, can overwhelm the sewer system and cause combined sewer overflows. In addition, having vegetation absorb stormwater can increase the longevity of a building by not absorbing the water that would otherwise infiltrate the walls.

Greenwich Village is not classified as an environmental justice community and doesn't meet the SPROUT programs' target criteria. However, it serves as a model for what can be achieved in areas lacking green infrastructures and facing greater environmental risks. The success of the rooftop garden demonstrates the different ways they can be used as environmental tools. Implementing them in school not only enhances the surrounding environment but also helps cultivate environmental stewardship among students. ■



New York PS 41, before and after a green roof (Image from Live Roofs via Greenroofs.com)



Section 3

Conclusion



3.1 Conclusion

The Climate Change Relief for Urban Areas Act of 2023 represents a significant step towards addressing the pressing environmental challenges urban communities face, particularly those disproportionately affected by climate change and historical injustices. This comprehensive legislation aims to mitigate the urban heat island effect, reduce air pollution, manage stormwater runoff, and improve food security through targeted green infrastructure initiatives.

The bill's focus on prioritizing communities with low Tree Equity Scores and Garden Equity Scores demonstrates a commitment to environmental justice, recognizing the intersectionality of environmental and socioeconomic factors. By mandating the reprioritization of federal forestry funding and creating a pilot grant program for school rooftop gardens, the Act seeks to deliver tangible benefits to those communities experiencing the greatest need.

Our proposed SPROUT program, designed to implement Section 3 of the bill, offers a structured approach to establishing rooftop gardens in public schools. This initiative not only addresses immediate environmental concerns but also provides educational opportunities and promotes long-term environmental stewardship among students. The program's design, which considers economic, human health, and environmental impacts, ensures a holistic approach to urban greening.

The implementation logistics outlined in this report provide a clear roadmap for the program's first year, focusing on developing the Garden Equity Score, establishing the grant application process, and retaining capable staff to focus on building up the groundwork necessary for future success. These initial steps are crucial for

ensuring that the program's benefits reach the most vulnerable communities effectively.

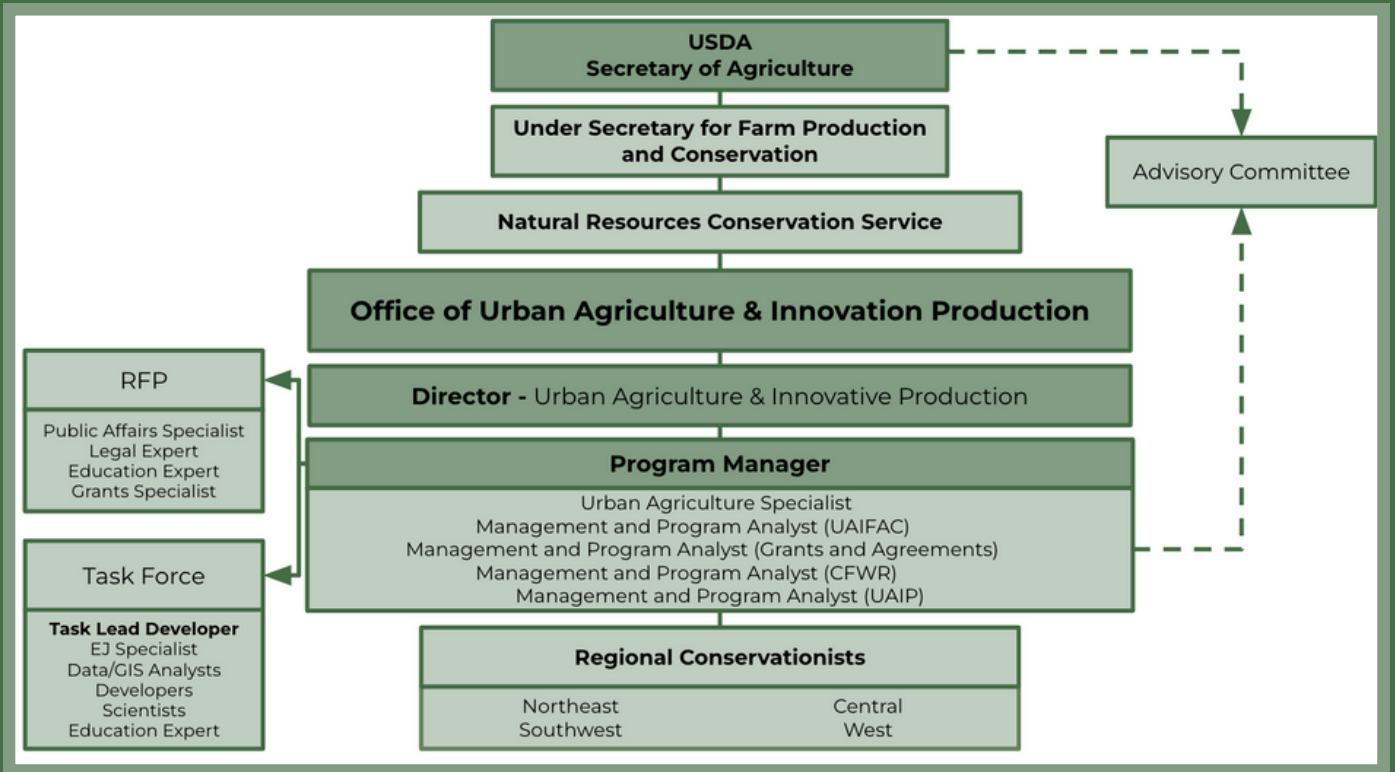
As urbanization continues to accelerate and climate change intensifies, the need for such targeted interventions becomes increasingly urgent. The bill represents important steps toward creating more resilient, equitable, and sustainable urban environments. By addressing both environmental and social challenges, these initiatives have the potential to significantly improve the quality of life for millions of urban residents, particularly those in historically marginalized communities. The success of this initiative could serve as a model for future public urban environmental policies and projects, demonstrating the power of targeted, equity-focused approaches in addressing complex environmental challenges in our cities. ■



*"Rooftop Garden", Evan Long,
CC BY-NC 2.0, 2010 via Flickr*

APPENDIX A

Organizational Chart



APPENDIX B

H. R. 2786

118TH CONGRESS
1ST SESSION

H. R. 2786

To amend the Cooperative Forestry Assistance Act of 1978 to prioritize urban and community forestry assistance for areas with low tree equity scores, to establish a grant program to enhance public elementary and secondary school rooftop gardens, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

APRIL 20, 2023

Mr. SCHIFF (for himself, Ms. BARRAGÁN, Ms. OCASIO-CORTEZ, Ms. BROWN, Ms. CLARKE of New York, Mr. ESPAILLAT, Mr. EVANS, Mr. GOMEZ, Mr. GRIJALVA, Ms. KAMLAGER-DOVE, Ms. MENG, Ms. SALINAS, Ms. SÁNCHEZ, Ms. SCANLON, Mr. TAKANO, and Mrs. WATSON COLEMAN) introduced the following bill; which was referred to the Committee on Agriculture, and in addition to the Committee on Education and the Workforce, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

A BILL

To amend the Cooperative Forestry Assistance Act of 1978 to prioritize urban and community forestry assistance for areas with low tree equity scores, to establish a grant program to enhance public elementary and secondary school rooftop gardens, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “Climate Change Relief
3 for Urban Areas Act of 2023”.

4 **SEC. 2. PRIORITIZATION OF URBAN AND COMMUNITY FOR-**
5 **ESTRY ASSISTANCE TO AREAS WITH LOW**
6 **TREE EQUITY SCORES.**

7 Section 9 of the Cooperative Forestry Assistance Act
8 of 1978 (16 U.S.C. 2105) is amended—

9 (1) in subsection (c), by adding at the end the
10 following: “In carrying out this section, the Sec-
11 retary shall give priority to providing assistance to
12 State foresters or equivalent State officials serving
13 areas with the lowest tree equity scores, as deter-
14 mined by the Secretary”;

15 (2) in subsection (h)—

16 (A) in paragraph (2), by striking “and” at
17 the end;

18 (B) in paragraph (3), by striking the pe-
19 riod and adding “; and”; and

20 (C) by adding at the end the following:

21 “(4) the term ‘tree equity score’ means a tree
22 equity score, as determined by the Secretary, that
23 is—

24 “(A) either—

25 “(i) substantially similar to the tree
26 equity score established by American For-

1 ests (or a successor tree equity score devel-
 2 oped by such conservation organization or
 3 other similar organization); or

4 “(ii) a tree equity tool that the Sec-
 5 retary determines is most appropriate for
 6 the communities served by such tool; and

7 “(B) based on how the tree canopy and
 8 surface temperature of an area align with in-
 9 come, employment, race, age, and health factors
 10 of that area as determined by consulting with
 11 community representatives or community-based
 12 organizations.”; and

13 (3) in subsection (i), by striking “fiscal years
 14 1991 through 1995” and inserting “fiscal years
 15 2023 through 2028”.

16 **SEC. 3. PILOT GRANT PROGRAM TO PUBLIC ELEMENTARY**
 17 **AND SECONDARY SCHOOL ROOFTOP GAR-**
 18 **DENS.**

19 (a) **PILOT PROGRAM ESTABLISHED.**—The Secretary
 20 shall establish a competitive grant program under which
 21 the Secretary shall make grants to eligible entities to es-
 22 tablish or expand rooftop gardens.

23 (b) **APPLICATION.**—To be eligible to receive a grant
 24 under this section, an eligible entity shall submit to the
 25 Secretary an application at such time, in such manner,

1 and containing such information as the Secretary may re-
2 quire, including the square feet of the proposed rooftop
3 garden (or expansion of such rooftop garden).

4 (c) PRIORITY.—In awarding grants under this sec-
5 tion, the Secretary shall give priority to the eligible entities
6 that have the lowest garden equity score, as determined
7 by the Secretary based on, with respect to the area in
8 which the eligible entity is located, the population density,
9 racial composition, incidence of respiratory illness, number
10 of urban gardens, food sovereignty, and average surface
11 temperature.

12 (d) USE OF FUNDS.—An eligible entity that receives
13 a grant under this section shall use the grant funds to
14 carry out each of the following:

15 (1) Assessing (including through architectural
16 analysis) if the area identified for purposes of estab-
17 lishing or expanding a rooftop garden can support
18 such garden or expansion and the construction
19 thereof.

20 (2) Applying for permits with respect to such
21 rooftop garden.

22 (3) Establishing a financial plan with respect to
23 the establishment or expansion of such rooftop gar-
24 den.

25 (4) Designing a rooftop garden—

1 (A) of which at least 20 percent is com-
2 prised of native plants, fruits, or vegetables;

3 (B) that does not include plants identified
4 by the State in which such garden is located as
5 invasive species;

6 (C) using best practices to reduce risk of
7 contaminants (such as using cleaning soil in
8 raised garden beds); and

9 (D) either—

10 (i) a strategy for increasing energy ef-
11 ficiency and increasing the surface ability
12 of a building to reflect sunlight and absorb
13 less solar energy; or

14 (ii) if the strategy in clause (i) is not
15 feasible, a strategy to increase habitat and
16 food availability for pollinators, manage
17 rainwater, or provide other benefits to the
18 community.

19 (5) Incorporating into the science curriculum of
20 the entity—

21 (A) an urban agriculture lesson plan; or

22 (B) a lesson plan on pollinator habitat,
23 green infrastructure for heat or stormwater
24 management, or remediation of soil and water
25 contaminants by plants.

1 (e) ORGANIC REQUIREMENT.—An eligible entity that
2 receives a grant under this section may only use organic
3 farming methods with respect to a rooftop garden estab-
4 lished or expanded by such grant.

5 (f) ROUTINE INSPECTIONS.—

6 (1) IN GENERAL.—The Secretary shall inspect
7 each rooftop garden for which a grant is awarded
8 under this section once each year.

9 (2) CONTRACT AUTHORITY.—The Secretary
10 may enter into contracts with appropriate entities to
11 carry out the inspections required under paragraph
12 (1).

13 (g) DEFINITIONS.—In this section:

14 (1) ELIGIBLE ENTITY.—The term “eligible enti-
15 ty” means a public elementary school or secondary
16 school.

17 (2) ESEA TERMS.—The terms “elementary
18 school” and “secondary school” have the meanings
19 given the terms in section 8101 of the Elementary
20 and Secondary Education Act of 1965 (20 U.S.C.
21 7801).

22 (3) SECRETARY.—The term “Secretary” means
23 the Secretary of Agriculture.

1 (h) AUTHORIZATION OF APPROPRIATIONS.—There is
2 authorized to be appropriated to carry out this section
3 \$30,000,000 for each of fiscal years 2023 through 2028.

○

APPENDIX C

Master Calendar

[illegible]

APPENDIX D

Interview Key Takeaways

Jason Smith

Director, Northern Manhattan Parks, New York Restoration Project (NYRP)

- NYRP is a non-profit organization dedicated to providing access to well-managed green spaces for all New Yorkers and owns 52 community gardens citywide, protected under a Land Trust to prevent redevelopment.
- Many NYRP gardens focus on food production, but community groups themselves decide how the garden will be used.
- NYRP work involves three main programs:
 - **Community Gardens:** NYRP owns and operates community gardens in all five boroughs.
 - **Park Stewardship:** Long-term care and improvements of parks, especially in Northern Manhattan.
 - **Gardens for the City:** Create or renovate gardens based on applications from New York communities. NYRP completes about 2 projects annually.
- Bottom-up approach is applicants submit their own proposals rather than NYRP deciding top-down which neighborhoods need gardens.
- Evaluation criteria include alignment with NYRP mission, underserved neighborhood status, public access, feasibility, and corporate match sponsors.
- NYRP departments include the Capital Department, Fundraising and Marketing Department, Urban Agriculture Department, Finance and Accounting Department, and Operations Department.
- Internal staff are responsible for most of its projects, including planning, selecting projects, and garden construction.
- External contractors are brought in for larger or specialized projects, including technical repairs, academics, and consultants.
- Small garden projects can be completed in 6 months, while larger public park projects can take years.
- NYRP doesn't always perform deep analysis (5 years to measure) unless required by a project, focusing more on practical metrics like litter removal.
- Limited Rooftop Gardens involvement due to transporting soil, structural integrity assessments, ensuring water availability, and maintenance issues.

Mary-Virginia Potter

Education Specialist of EPA Office of Environmental Education

The Office of Environmental Education (OEE): under the EPA, this office is responsible for the implementation of the **National Environmental Education Act (NEEA) of 1990**, which aims to promote environmental education and enhance environmental literacy. Particularly through training programs, environmental grants, and providing educational materials that are mandated under the law.

Difficulties in Designing Programs within a Federal Agency

- Within the OEE, the NEEA expired in 199 and has not been reauthorized. This has reduced their appropriations and they resort to getting funding from outside people, like through lobbying.
- Lack of funding (10 million/year) means they have to be selective in the type of program and solely focus on programs that are federally mandated, like the **National Teacher Training Program, Education Grant Program, and the President's Environmental Youth Award Program**
- The selective process limits the diversity of programs and hinders their ability to do more in enhancing environmental literacy through innovative projects, such as student internship opportunities or forestry programs.
- Programs take a lot of time and resources to run. Practicality is also another factor to consider because there are limited employees (only 3-4 full-time employees) who are over-extended in designing and running programs, in addition to having to find other funding avenues.
- If the office is considering a new program and working with another agency, they have to find intersections to align the work because every federal agency is underfunded and has different legislative authorities.

Multi-Agency Collaborations

- **EE Works:** a program in collaboration with the Fish and Wildlife Service and Forest Service that works to demonstrate the impact and value of environmental education by using quantitative data. Multi-agency effort to show how environmental education can achieve conservation goals.
- Working with the National Oceanic and Atmospheric Administration (NOAA) and the National Park Service (NPS) to share program ideas and discuss current programs in each agency that have the ability to intersect.
- While the OEE's whole focus surrounds the NEEA, there are more discussions in federal agencies to develop climate mitigation and resilience programs.

Mary-Virginia Potter continued

Education Specialist of EPA Office of Environmental Education

What to Consider in Program Designing

- Leverage existing models and programs wherever possible to streamline development but ensure they align with new program goals and legal requirements.
- Clearly outline expectations in the RFP, including the need for grant applicants to correlate programs with relevant education standards.
- Building a federal program from scratch often requires a year or more to develop prototypes and frameworks before implementation can begin.
- The program's timeline is optimistic, especially in creating the Garden Equity Score and RFP within one year.
- Collaboration between federal agencies is often constrained by differing legislative authorities and resource limitations.
- Successful partnerships require clearly defined, mutually beneficial objectives and must align with each agency's mandates and capabilities.
- Public comment periods for federal programs often require additional permissions and processes, such as ICRs, which can extend timelines significantly.
- Education-based programs need to align with state and national standards, For example, Next Generation Science Standards and Common Core, in order to see adoption in schools.
- The education curriculum should be developed by experienced educators who are able to set up educational aims and standards.
- The success of a program needs realistic planning and adjustments, with considerations of resource availability and other administrative processes.

Sharonte Williams

Grant Management and Program Analyst in the Grants and Agreement department, OUAIP

RFP development process:

The request for proposal requires using a template from the Grants and Agreement division and tailoring it to the specific program needs by removing unnecessary sections. When developing a request proposal, it is important to aim for clarity and simplicity for applicants to understand. The proposal goes through an internal review process involving multiple USDA offices which can take four to six months.

Reducing administrative burden:

To provide technical assistance to the applicants, the Grant and Agreement division mostly uses webinars and FAQs. It is important to maintain the previous year's resources for preparation but also use streamlined forms for budget and contact information.

Outreach and Accessibility:

Some programs worked in this division include the Urban Agriculture and Innovative Production grant program and the Compost and Food Waste Reduction Cooperative Agreement program. These are examples of programs that target underserved communities and areas focused on food security. For the outreach component of these programs, they used newsletters, past recipients' experiences, and highlights, as well as various other outreach platforms.

Application Review and Selection:

The review process is a two-phase process. It includes an administrative and technical review. They then use a scoring rubric to ensure a fair and unbiased selection process. The final grant recipient selection is made by the chief of the National Resources Conservation Service.

Grant Management and Reporting:

The division requires quarterly financial reports and annual progress reports to be submitted by the applicants. The officials have a kickoff meeting with the different recipients in order to explain the different requirements. Once the funds are distributed the office will focus on monitoring.

Sharonte Williams continued

Grant Management and Program Analyst in the Grants and Agreement department, OUAIP

Collaboration and Partnerships:

Grant applicants must have at least two partners for the implementation of their program; these partners can include ineligible entities as long their roles are clearly defined. In general, the grant review process includes Internal USDA staff members

Challenges and Considerations:

One of the major challenges often faced is budget constraints being limiting factors when it comes to the number of projects that can be funded. On top of that, applicants tend to overlook important information provided in the Notice of Funding Availability. Often, staff turnover in the recipient organizations can impact the implementation of the project.

WORKS CITED

ACSA (Association of Collegiate Schools of Architecture). 2024. "Annual Meeting Proceedings." Proceedings of the 111th Annual Meeting. Accessed December 1, 2024. <https://www.acsa-arch.org/proceedings/Annual%20Meeting%20Proceedings/ACSA.AM.111/ACSA.AM.111.53.pdf>.

American Public Health Association. 2024. "Extreme Heat Resource Hub." ALPHA. 2024. <https://www.apha.org/topics-and-issues/climate-health-and-equity/extreme-heat>.

Anderson, G. Brooke, and Michelle L. Bell. 2011. "Heat Waves in the United States: Mortality Risk during Heat Waves and Effect Modification by Heat Wave Characteristics in 43 U.S. Communities." *Environmental Health Perspectives* 119 (2): 210–18. <https://doi.org/10.1289/ehp.1002313>.

Aram, Farshid, Ester Higuera García, Ebrahim Solgi, and Soran Mansournia. "Urban Green Space Cooling Effect in Cities." *Heliyon* 5, no. 4 (2019): e01339. <https://doi.org/10.1016/j.heliyon.2019.e01339>.

Binkovitz, Leah. 2017. "Houston, Urbanization and Flooding: A Reading Guide." Rice University Kinder Institute for Urban Research. August 29, 2017. <https://kinder.rice.edu/urbanedge/houston-urbanization-and-flooding-reading-guide>.

California Environmental Justice Alliance. 2016. "Defining Environmental Justice Communities: Using CalEnviroScreen in State Policy." California Environmental Justice Alliance (CEJA) (blog). September 14, 2016. <https://caleja.org/2016/09/defining-environmental-justice-communities-using-calenviroscreen-in-state-policy/>.

Center for Sustainable Systems, University of Michigan. "U.S. Cities Factsheet." Pub. No. CSS09-06. December 1, 2024. <https://css.umich.edu/publications/factsheets/built-environment/us-cities-factsheet>.

Clay, Lauren A., and Ashley D. Ross. 2020. "Factors Associated with Food Insecurity Following Hurricane Harvey in Texas." *International Journal of Environmental Research and Public Health* 17 (3): 762. <https://doi.org/10.3390/ijerph17030762>.

Climate Central. 2023. "Urban Heat Hot Spots." July 26, 2023. <https://www.climatecentral.org/climate-matters/urban-heat-islands-2023>.

Colon, Shayla. "Brush Fire under Control in Inwood Hill Park in Manhattan." *The New York Times*, November 13, 2024. <https://www.nytimes.com/2024/11/13/nyregion/inwood-hill-park-fire-nyc.html?searchResultPosition=5>.

Colon, Shayla. "Brush Fire in Brooklyn's Prospect Park Burns 2 Acres." *The New York Times*, November 9, 2024.

WORKS CITED

ACSA (Association of Collegiate Schools of Architecture). 2024. "Annual Meeting Proceedings." Proceedings of the 111th Annual Meeting. Accessed December 1, 2024. <https://www.acsa-arch.org/proceedings/Annual%20Meeting%20Proceedings/ACSA.AM.111/ACSA.AM.111.53.pdf>.

American Public Health Association. 2024. "Extreme Heat Resource Hub." ALPHA. 2024. <https://www.apha.org/topics-and-issues/climate-health-and-equity/extreme-heat>.

Anderson, G. Brooke, and Michelle L. Bell. 2011. "Heat Waves in the United States: Mortality Risk during Heat Waves and Effect Modification by Heat Wave Characteristics in 43 U.S. Communities." *Environmental Health Perspectives* 119 (2): 210–18. <https://doi.org/10.1289/ehp.1002313>.

Aram, Farshid, Ester Higuera García, Ebrahim Solgi, and Soran Mansournia. "Urban Green Space Cooling Effect in Cities." *Heliyon* 5, no. 4 (2019): e01339. <https://doi.org/10.1016/j.heliyon.2019.e01339>.

Binkovitz, Leah. 2017. "Houston, Urbanization and Flooding: A Reading Guide." Rice University Kinder Institute for Urban Research. August 29, 2017. <https://kinder.rice.edu/urbanedge/houston-urbanization-and-flooding-reading-guide>.

California Environmental Justice Alliance. 2016. "Defining Environmental Justice Communities: Using CalEnviroScreen in State Policy." California Environmental Justice Alliance (CEJA) (blog). September 14, 2016. <https://caleja.org/2016/09/defining-environmental-justice-communities-using-calenviroscreen-in-state-policy/>.

Center for Sustainable Systems, University of Michigan. "U.S. Cities Factsheet." Pub. No. CSS09-06. December 1, 2024. <https://css.umich.edu/publications/factsheets/built-environment/us-cities-factsheet>.

Clay, Lauren A., and Ashley D. Ross. 2020. "Factors Associated with Food Insecurity Following Hurricane Harvey in Texas." *International Journal of Environmental Research and Public Health* 17 (3): 762. <https://doi.org/10.3390/ijerph17030762>.

Climate Central. 2023. "Urban Heat Hot Spots." July 26, 2023. <https://www.climatecentral.org/climate-matters/urban-heat-islands-2023>.

Colon, Shayla. "Brush Fire under Control in Inwood Hill Park in Manhattan." *The New York Times*, November 13, 2024. <https://www.nytimes.com/2024/11/13/nyregion/inwood-hill-park-fire-nyc.html?searchResultPosition=5>.

Colon, Shayla. "Brush Fire in Brooklyn's Prospect Park Burns 2 Acres." *The New York Times*, November 9, 2024. <https://www.nytimes.com/2024/11/08/nyregion/prospect-park-fire.html>.

WORKS CITED

Cooperative Forestry Assistance Act of 1978. 1978. U.S. Code. Vol. 16.

[https://uscode.house.gov/view.xhtml?req=\(title:16%20section:2105%20edition:prelim\)#amendment-note](https://uscode.house.gov/view.xhtml?req=(title:16%20section:2105%20edition:prelim)#amendment-note).

D'Souza, Anthony, Inyang Uwak, Jennifer Hadaiya, Riikka Pohjankoski, Chad Milando, and Amy Truong. n.d. "How Industrial Emissions in Harris County Impact Asthma Rates and Excess Deaths." Air Alliance Houston. <https://airalliancehouston.org/wp-content/uploads/2023/12/AAH-AERMOD-Report-ENG.pdf>.

Elmes, Arthur, John Rogan, Christopher Williams, Samuel Ratick, David Nowak, and Deborah Martin. 2017. "Effects of Urban Tree Canopy Loss on Land Surface Temperature Magnitude and Timing." ISPRS Journal of Photogrammetry and Remote Sensing 128: 338–353.

Estevez, Jerielys. 2020. "An Analysis of Environmental Racism in the South Bronx: A Discussion on the Negligent, Potentially Racist Political Practices That Have Created Conditions for Dangerous Air Quality in the South Bronx." Department of Political Science, School of Social Sciences, Purchase College, State University of New York. Senior Project.

https://soar.suny.edu/bitstream/handle/20.500.12648/13487/4557_jerielys.estevez.pdf?sequence=1&isAllowed=y.

Gamarro, H., Ortiz, L., and González, J. E. (September 9, 2020). "Adapting to Extreme Heat: Social, Atmospheric, and Infrastructure Impacts of Air-Conditioning in Megacities—The Case of New York City." ASME. J. Eng. Sustain. Bldgs. Cities. August 2020; 1(3): 031005. <https://doi.org/10.1115/1.4048175>

Global Forest Watch. n.d. "New York, United States Deforestation Rates & Statistics." Accessed June 16, 2024. <https://www.globalforestwatch.org/dashboards/country/USA/33>.

Great Lakes Integrated Sciences and Assessments. 2024. "Extreme Precipitation." Accessed December 2, 2024. <https://glisa.umich.edu/resources-tools/climate-impacts/extreme-precipitation/>.

"Heat-Related Deaths - United States, 2004–2018." Centers for Disease Control and Prevention, June 18, 2020. <https://www.cdc.gov/mmwr/volumes/69/wr/mm6924a1.htm>.

Howard JT, Androne N, Alcover KC, Santos-Lozada AR. Trends of Heat-Related Deaths in the US, 1999–2023. JAMA. 2024;332(14):1203–1204. doi:10.1001/jama.2024.16386

Mark Lopez, dir. 2019. Segregated By Design. <https://www.segregatedbydesign.com>.

Martin, Anikka. 2024. "Food Prices and Spending." USDA Economic Research Service. 2024. <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending/?topicId=2b168260-a717-4708-a264-cb354e815c67>.

WORKS CITED

MENA Report. 2022. "United States: Federal Health Agencies Unveil National Tool to Measure Health Impacts of Environmental Burdens." Accessed December 1, 2024.

Miami Dade County Office of Resilience. 2024. "Understanding Heat Exposure in Miami-Dade County." ArcGIS StoryMaps. April 26, 2024.
<https://storymaps.arcgis.com/stories/6f1e91cf8a8e4d5d9bd67525575c042e>.

NASA. "Extreme Makeover: Human Activities Are Making Some Extreme Events More Frequent or Intense - NASA Science." Accessed November 30, 2024. <https://science.nasa.gov/earth/climate-change/extreme-makeover-human-activities-are-making-some-extreme-events-more-frequent-or-intense/>

New York City Department of Parks & Recreation. "Cooling Our City." September 22, 2022.
<https://www.nycgovparks.org/learn/sustainability/cooling-our-city>.

New York State Division of Lands and Forests. n.d. "Heat Island Effects." Accessed June 16, 2024.
<https://dec.ny.gov/nature/forests-trees/urban-and-community-forestry/heat-island-effects>.

"New York PS41 Greenroof Environmental Literacy Laboratory (Gell)," Greenroofs.com, October 29, 2020, <https://www.greenroofs.com/projects/new-york-ps41-greenroof-environmental-literacy-laboratory-gell/>

NYC Dohmh. 2021. "Asthma-related Health Disparities in the Bronx." Epi Data Brief.
<https://www.nyc.gov/assets/doh/downloads/pdf/epi/databrief126.pdf>.

NYC Parks. 2022. "How NYC Parks Fights Climate Change: Cooling Our City : NYC Parks." 2022.
<https://www.nycgovparks.org/learn/sustainability/cooling-our-city>.

Nowak, David J., and Eric J. Greenfield. "Declining Urban and Community Tree Cover in the United States." Urban Forestry & Urban Greening 32 (2018): 32–55. <https://doi.org/10.1016/j.ufug.2018.03.006>.

Pasche, Madison. 2024. "Mitigating Extreme Flood Risk in Historically Redlined Areas." Enterprise Community Partners. February 28, 2024. <https://www.enterprisecommunity.org/blog/mitigating-extreme-flood-risk-historically-redlined-areas>.

Schiff, Adam B. Climate Change Relief for Urban Areas Act of 2023, Pub. L. No. H.R.2786 (2023).
<https://www.congress.gov/bill/118th-congress/house-bill/2786/texts=1&r=1&q=%7B%22search%22%3A%22hr2786%22%7D>.

WORKS CITED

Team XQ. 2024a. "At This Innovative Urban High School Project-based Learning Addresses Environmental Justice." XQ (blog). July 27, 2024. <https://xqsuperschool.org/teaching-learning/xq-school-students-project-based-learning-environmental-justice/>.

Team XQ. 2024b. "Hope Thrives From This High School's Community Garden." XQ (blog). July 27, 2024. <https://xqsuperschool.org/teaching-learning/hope-thrives-from-this-high-schools-community-garden/>.

The Nature Conservancy. 2022. "Satellite Imagery Highlights Ties Between Green Streets and Healthy Streams." The Nature Conservancy. February 18, 2022. <https://www.nature.org/en-us/what-we-do/our-insights/perspectives/second-nature-stormwater-urban-green/>.

"Tree Equity - American Forests." 2024. American Forests. September 10, 2024. <https://www.americanforests.org/our-programs/tree-equity/>.

TreePhilly. 2024. "About Us." Pennsylvania Horticultural Society. Accessed December 1, 2024. <https://treephilly.org/about/#:~:text=About%20Us,for%20the%20Philadelphia%20urban%20forest.>

U.S. Climate Resilience Toolkit. 2020. "Relationship Between Impervious Cover and Surface Runoff." U.S. Climate Resilience Toolkit. 2020. <https://toolkit.climate.gov/image/2907>.

US Department of Commerce, NOAA. n.d. "What Is the Heat Index?" NOAA's National Weather Service. Accessed June 25, 2024. <https://www.weather.gov/ama/heatindex#>.

USDAa. "Office of the Chief Directory." Natural Resources Conservation Service. Accessed November 20, 2024. <https://www.nrcs.usda.gov/group/143/office-of-the-chief-directory>.

USDAb. "USDA Announces Grants for Urban Agriculture and Innovative Production." Natural Resources Conservation Service, January 26, 2023. <https://www.nrcs.usda.gov/news/usda-announces-grants-for-urban-agriculture-and-innovative-production-0>.

U.S. Environmental Protection Agency. 2019. "Heat Islands and Equity." Overviews and Factsheets. EPA. November 6, 2019. <https://www.epa.gov/heatislands/heat-islands-and-equity>.

U.S. Environmental Protection Agency. "Heat Island Effect." Accessed December 2, 2024. <https://www.epa.gov/heatislands>.

U.S. Forest Service. Forest Service, urban and community forestry, who we are, 2021. <https://www.fs.usda.gov/sites/default/files/fs-urban-community-forestry-who-we-are.pdf>.

WORKS CITED

U.S. Forest Service. Urban and Community Forestry Program. US Forest Service. Accessed November 20, 2024. <https://www.fs.usda.gov/managing-land/urban-forests/ucf>.

"U.S. Urban Population 1960-2024," MacroTrends, accessed December 1, 2024, <https://www.macrotrends.net/global-metrics/countries/USA/united-states/urban-population>.

Velazquez, Nydia M. Public School Green Rooftop Program, Pub. L. No. H.R.7693 (2020). <https://www.congress.gov/bill/116th-congress/house-bill/7693/text>

White House Council of Environmental Quality. n.d. "Climate and Economic Justice Screening Tool." <https://screeningtool.geoplatform.gov/en/#10.68/29.7334/-95.2884>.

World Health Organization. 2024. "Health Risks." WHO. 2024. <https://www.who.int/initiatives/urban-health-initiative/health-impacts/other-health-risks>.

Wu, Yutian. 2024. Climatology.

Zhong, Raymond, and Nadja Popovich. 2022. "How Air Pollution across America Reflects Racist Policy from the 1930s." The Boston Globe. March 9, 2022. <https://www.bostonglobe.com/2022/03/09/nation/how-air-pollution-across-america-reflects-racist-policy-1930s/>.



*The Garden of Happiness, in
the Bronx, New York City
Image from USDA, via Flickr*