

## Mapping for Justice: How EJScreen Advances Science Education and Community Advocacy

Monica L. Miles\* and Tendaji Ya'Ukuu

Assistant Professor, Engineering Education, School of Engineering and Applied Sciences, 721 O'Brian Hall

\*Corresponding author: Dr. Monica L. Miles, Assistant Professor, Engineering Education, School of Engineering and Applied Sciences, 721 O'Brian Hall. Tel: 716-507-6147. Email: mlr25@buffalo.edu

**Citation:** Miles ML and Ya'Ukuu T (2024) Mapping for Justice: How EJScreen Advances Science Education and Community Advocacy. American J Sci Edu Re: AJSER-219.

**Received Date:** 30 November, 2024; **Accepted Date:** 05 December, 2024; **Published Date:** 11 December, 2024

### Abstract

*This case report explores the integration of the U.S. Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EJScreen, version 2.3) into science education and environmental advocacy initiatives, using Buffalo's East Side as a focal point. EJScreen offers accessible environmental and demographic data that can illuminate systemic inequities, empowering communities and students to identify and address environmental justice challenges. Our approach employed pairing data with local knowledge to interpret environmental issues effectively. By leveraging tools like EJScreen, science education can empower students to engage with real-world issues, fostering critical thinking and equipping them to drive informed, equitable, and sustainable solutions in their communities.*

**Keywords:** environmental justice, EJScreen, community engagement, education.

### Introduction

This case report demonstrates the potential of the U.S. Environmental Protection Agency's (EPA) Environmental Justice Screening and Mapping Tool (EJScreen, version 2.3) as both an educational resource and a catalyst for environmental advocacy. By integrating EJScreen into science education, we show how this web-based mapping platform can empower students, educators, and community members by providing direct access to actionable environmental and demographic data. Through this engagement, EJScreen fosters essential skills in data literacy, critical thinking, and informed advocacy, creating a bridge between scientific knowledge and community-driven solutions.

Our work aligns with federal environmental justice initiatives, such as the Justice40 program, which aims to direct 40% of federal investments toward disadvantaged communities, addressing key issues like climate change, clean energy, and the remediation of legacy pollution [1]. By leveraging EJScreen to identify and communicate environmental and health disparities on Buffalo's East Side, we emphasize the role of science education in advancing equitable policies and promoting sustainable, community-led change [2]. This case report illustrates how tools like EJScreen can deepen students' understanding of environmental justice and empower them to advocate for local and systemic solutions to address entrenched inequities.

### What is EJScreen?

EJScreen, developed by the EPA, is a free and open-to-the-public web-based mapping and screening tool designed to identify communities disproportionately burdened by environmental and social stressors (<https://www.epa.gov/ejscreen>; EPA, 2023) [3]. EJScreen integrates federal data on environmental indicators, such as air quality, proximity to hazardous waste sites, and traffic density, with census data containing demographic factors like income, race, and education

levels (EPA, 2023) [3]. Its user-friendly interface eliminates the need for a Geographic Information System (GIS) background or specialized software, making it accessible to a wide range of users, from policymakers to community advocates [4]. The screening tool permits a layered approach that allows users to assess cumulative impacts and identify areas of environmental injustice [4]. EJScreen is a powerful data entry point for understanding federal initiatives like Justice40, providing data-driven insights that support equity and justice advocacy [1].

EJScreen has been instrumental in identifying and addressing environmental justice concerns by mapping vulnerable communities' exposure to environmental and demographic stressors. For example, in Columbus, Ohio, the tool revealed elevated levels of particulate matter (PM2.5) and proximity to traffic, placing the city in the 90th percentile for traffic proximity and volume. This highlighted the urgent need for targeted interventions to mitigate these risks. Similarly, in California, EJScreen's demographic and environmental analyses were utilized alongside CalEnviroScreen to pinpoint communities burdened by high pollution levels and socio-economic vulnerabilities. These insights have informed policy decisions, resource allocation, and community action plans to reduce disparities and promote environmental equity [5].

EJScreen is a widely used environmental justice tool that offers accessible visualizations and data mapping at the census block level; compared to tools like CalEnviroScreen and the CDC's Environmental Justice Index (EJI), EJScreen has limitations. It lacks benchmark thresholds for safe exposure, relying instead on percentile rankings, which restrict its ability to assess cumulative impacts. Tools like CalEnviroScreen incorporate state-specific indicators and community input, while the EJI evaluates cumulative health vulnerabilities, providing a more comprehensive analysis. EJScreen's general approach highlights disparities but underscores the need for more localized, community-focused tools in this case report, we

propose that, beyond policymaking, environmental justice screening tools like EJScreen and others serve as valuable resources for teaching science, fostering data literacy, and facilitating community engagement. By empowering students and community members with accessible data and mapping capabilities, these tools provide a foundation for understanding environmental disparities and enable informed action to address local issues and advocate for equitable solutions.

### **Community-Based Research Team**

Led by Monica Miles (first author), the Environmental Justice Action Research Lab works primarily with STEM undergraduate students and some graduate students at the University at Buffalo. Many of our team members are individuals of color and from marginalized communities, bringing a wealth of diverse perspectives and lived experiences to our work. This diversity is central to our mission, enabling us to deeply understand and address the environmental and social inequities that disproportionately impact Buffalo's East Side. By integrating academic training with real-world applications, our lab fosters a collaborative environment where students develop skills in research, advocacy, and community engagement. We actively involve undergraduate students in community-based research projects, providing them with hands-on opportunities to apply STEM knowledge to address pressing environmental justice issues [4]. How we structure our students' research experiences highlights the transformative role of undergraduate research in fostering students' confidence, aligning their motivations with research goals, and strengthening their sense of belonging in STEM fields [2]. By connecting students with community research, we enable them to see the tangible impacts of their work, reinforcing the value of their academic pursuits while cultivating a sense of responsibility toward the communities they serve.

Our efforts are guided by the complexities of Buffalo's East Side, an area stressed by economic disparities, environmental neglect, and limited resources. While some challenges, like air quality and hazardous waste proximity, affect the entire region, others are more localized, varying by neighborhood or block. To navigate this complexity, we collaborate closely with community members to identify and prioritize concerns, balancing the need to address pervasive, area-wide challenges with targeted interventions for localized problems. This approach ensures that our research remains grounded in community realities while equipping students with the skills and knowledge to create meaningful change. To address the need for accessible tools and actionable data in environmental justice advocacy, our team has hosted workshops for community members, K-12 students, educators, and STEM students. These sessions introduced participants to EJScreen and its updated features, teaching them how to interpret environmental and demographic data to identify and prioritize challenges impacting their communities.

Building on these efforts, Tendaji, an undergraduate student and co-author of this case report, presented findings from this work at the University at Buffalo's 3rd Annual Research Day: *Centering Health Equity*. Tendaji's community presentation entitled "Mapping Environmental Justice and Health Disparities in Buffalo's East Side: Insights from EJScreen and Literature Review" was one of only four presentations selected to be delivered before the entire conference audience, a prestigious honor typically reserved for faculty members and doctoral

candidates. As the only undergraduate presenter, Tendaji's work exemplified the transformative power of engaging nontraditional experts like students, educators, and community members in environmental justice initiatives. Tendaji's presentation highlighted using EJScreen and our test case as powerful examples of how expertise can be redefined to bridge the gap between science education and community action. By connecting local environmental challenges to actionable data, the presentation illustrated the potential of web-based tools to inspire informed advocacy, empower marginalized communities, and promote environmental justice. This example underscored the significant impact of student-led research in driving meaningful change while also showcasing how undergraduate engagement in science and advocacy contributes to advancing community-driven solutions.

### **Honoring Buffalo's East Side**

Our team approaches this work with a commitment to maintaining an anti-deficit lens so that our research does not perpetuate oppressive narratives or practices. By recognizing and honoring the strength, contributions, and historical significance of Buffalo's East Side, we strive to amplify the community's strengths and advocate for equitable solutions. This approach is rooted in a deep appreciation for the rich cultural and historical tapestry of our city, which informs our efforts to highlight systemic challenges while centering the lived experiences and agency of community members.

Buffalo's East Side, historically a predominantly Black (African American) community, has maintained a rich tradition of cultural contributions [6]. For example, the Michigan Street Baptist Church, established in 1845, is a pillar of the area's rich cultural heritage. It served as a center for social and political activism and played a strong role in the Underground Railroad, offering refuge to Freedom Seekers. The church's historical significance speaks to the East Side's longstanding commitment to civil rights and community empowerment. Additionally, the Colored Musicians Club, founded in 1917, provided a space for African American musicians to collaborate and perform during an era of segregation, contributing significantly to Buffalo's vibrant jazz scene [7]. In recent years, efforts have been made to revitalize the East Side, acknowledging its historical significance and the need for economic investment. Initiatives like the Michigan Street African American Heritage Corridor aim to preserve and promote the area's cultural landmarks, fostering tourism and education [8].

During the Great Migration (1916-1970), many African Americans moved to Buffalo for industrial employment, significantly increasing the Black population on the East Side [9]. However, discriminatory practices such as redlining, where financial institutions denied loans to residents in predominantly Black neighborhoods, restricted economic opportunities and reinforced residential segregation [6]. This segregation was further complicated by policies that concentrated environmental hazards, like the placement of hazardous waste, primarily dumped in communities of color, which impacted residents' health and wellness. Today, challenges persist, as some redevelopment projects have raised concerns about gentrification and the displacement of long-standing residents. Balancing economic development with preserving the community's cultural identity remains a critical focus for stakeholders committed to honoring the East Side's legacy while ensuring an equitable future [8].

**Methodology**

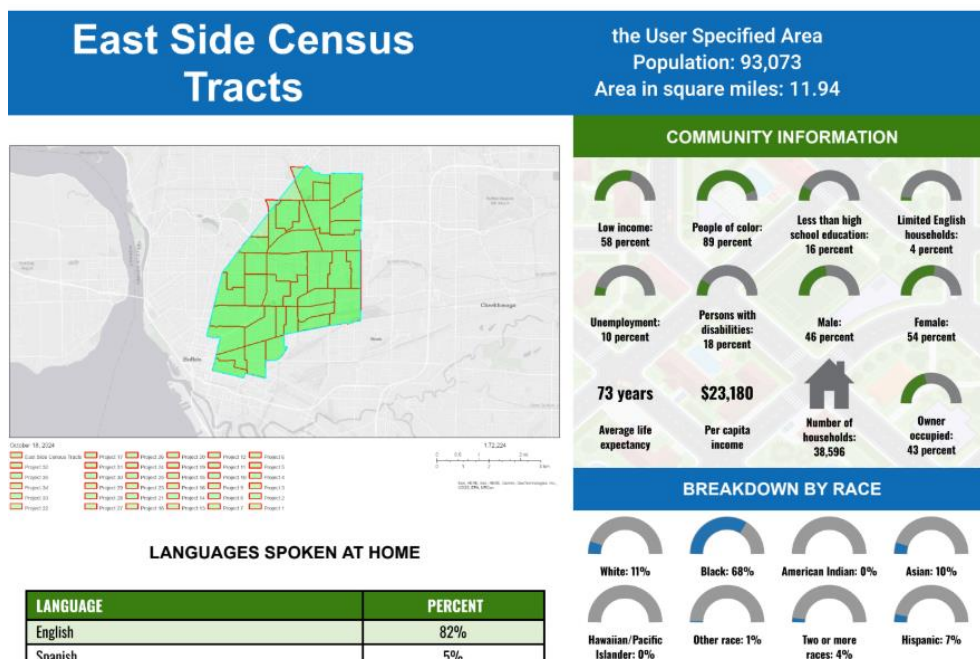
For this case report, we launched EJScreen in August 2024, sourced from the US Census, 2018–2022 American Community Survey 5-year estimates. We used the ‘draw an area’ feature to define and focus precisely on Buffalo’s East Side, a region historically impacted by economic inequality and environmental neglect. This approach allowed the research team to visualize and map data highlighting factors contributing to environmental and health inequities. EJScreen’s integration of demographic and environmental data provided a clear visualization of systemic challenges in the area, enabling stakeholders to identify priority issues and tailor interventions to the community’s needs.

**Defining the East Side using Draw an Area feature in EJScreen**

EJScreen’s ‘draw an area’ feature makes it ideal for empowering communities to define their own boundaries and gather targeted data that aligns with their unique priorities and concerns. Defining the East Side boundaries presented challenges, as its

borders can vary depending on who defines it. For example, some definitions rely on zip codes, while others align with census tracts. To address this community boundary issue, we referenced Dr. Henry Taylor’s *The Harder We Run* report, which provided a well-researched framework for identifying the boundaries of the East Side and included community input. Using EJScreen’s draw an area’ feature, we could outline the East side of Buffalo, enabling us to focus on the specific portions of census tracts that best represented the East Side (Figure 1). This flexible draw tool proved invaluable, especially in areas where the East side boundaries did not match completely with the census tract, allowing us to customize and compile data for the exact area of interest. This approach helped define the East Side for our project and offered a replicable strategy for other communities grappling with similarly fluid geographic identities. Once the area was drawn, we could download a customized report that revealed the heightened environmental risks faced by the area.

**Figure 1:** EPA EJScreen Boundaries and Socioeconomic Profile of East Side Buffalo, NY.

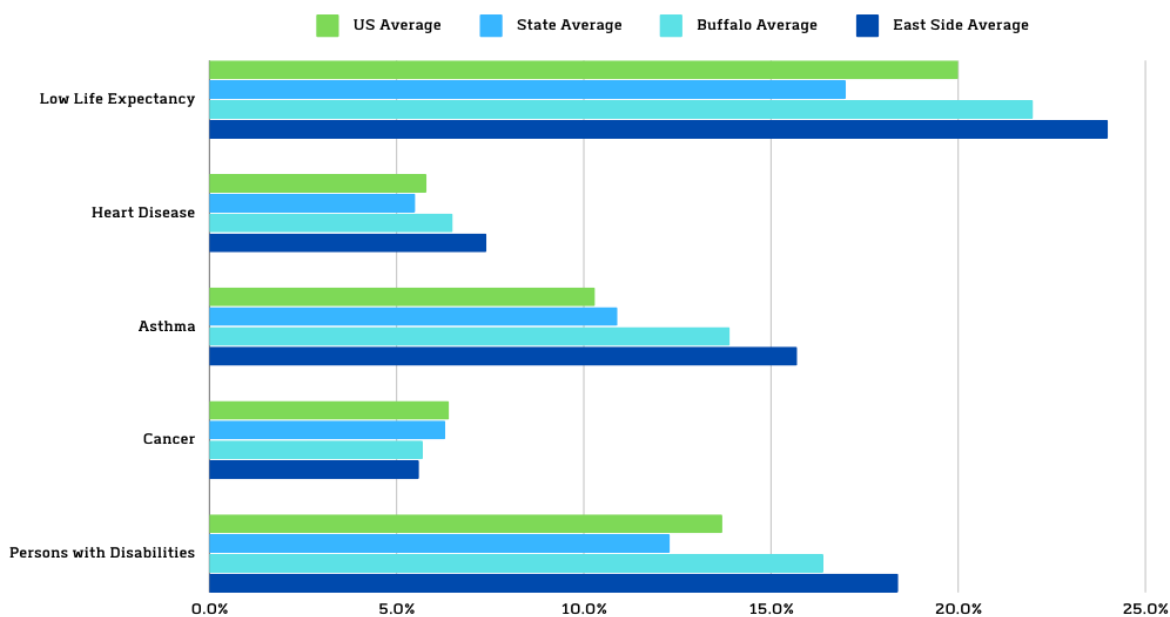


**Exporting the EJScreen Reports**

Buffalo’s East Side is home to 93,073 residents, nearly 68% of whom are Black. The area faces significant socio-economic challenges that exacerbate its environmental risks. Nearly 39% of residents live at or below the federal poverty line, with a per capita income of just \$23,180. The unemployment rate is high, at 10%, and housing insecurity is widespread, as only 43% of residents are homeowners, leaving the majority as renters. When combined with environmental hazards, these socio-economic struggles create a complex set of challenges that place the

community at greater risk of adverse health outcomes. Health indicators further illustrate these disparities. The East Side’s life expectancy of 78.5 years is lower than the state average, and asthma rates are notably high, at 15.7%, far above national averages (Figure 2). Residents also face heightened risks of heart disease and disability, adding to the long-term health burdens. While the East Side is home to 9 of Buffalo’s 15 hospitals, providing some access to medical care, residents’ social determinants of health continue to be negatively impacted at disproportionate rates in these communities.

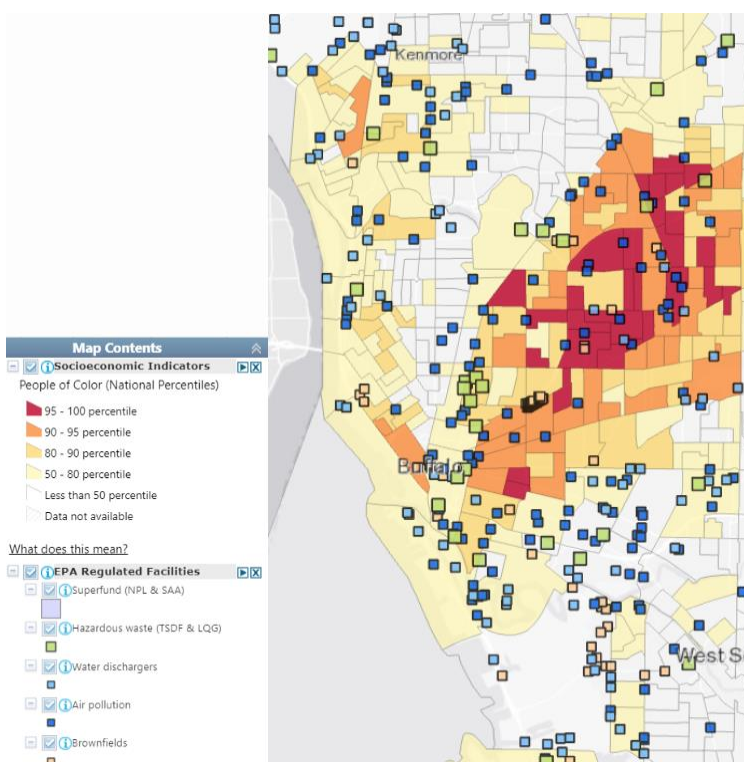
**Figure 2:** Comparison of Key Health Indicators for Buffalo's East Side, City of Buffalo, New York State, and the United States.



As seen in Figure 3, the data from the report emphasizes the severity of these risks, particularly regarding lead exposure and hazardous waste. Lead exposure in the area ranks in the 91st percentile, largely due to the aging housing stock. This is reflected in the high lead poisoning rates in ZIP codes 14211, 14212, 14213, and 14215, where lead levels are three to five times higher than the county average. In addition, hazardous waste proximity is a significant concern, with the area hosting an average of 5.8 facilities per kilometer (Figure 3). Traffic

exposure also ranks in the 82nd percentile, with over three million daily vehicle counts, further compounding environmental stressors on residents' health. The EPA EJScreen Map (Figure 3) reveals the concentration of EPA-regulated facilities in the East Side, with 8 out of 25 hazardous waste treatment, storage, and disposal facilities, 40 out of 153 air pollution sources, and 63 out of 99 brownfield sites located in this area.

**Figure 3:** Spatial Distribution of EPA-Regulated Facilities in Buffalo, NY: Overlay of People of Color Percentiles and Environmental Hazards.



### **Communicating Environmental Data to Broader Audiences**

We found that adding layers to the visual map and exporting the reports was one entry point for groups. However, understanding the maps and reports required data literacy, which became an essential tool for engaging a broader audience. Breaking down and contextualizing the graphs and percentages, such as elevated lead exposure, hazardous waste proximity, and poor health outcomes, can reveal inequities that disproportionately affect communities of color and poor communities in Buffalo. For those new to environmental justice, we have found it helpful to start with simple messages, like "Did you know that air pollution is linked to asthma?", and share the asthma rates and particulate matter data for the area. Explaining the EJScreen exported reports in ways that lay people can understand led to actionable engagement. The process of explaining the reports not only empowered workshop participants but also fostered a deeper understanding of how data-driven decision-making can drive environmental justice. The ability to effectively communicate these findings, and the tools used to gather them, is key to advancing public awareness and engagement. EJScreen, as a tool for visualizing and analyzing environmental risks, helped demystify these issues, making it easier for community members and stakeholders to understand the local environmental landscape and its implications.

### **Limitations of EJScreen**

While EJScreen is a powerful tool for identifying environmental and health disparities at a broad level, it has limitations in capturing the fine-grained details of localized community issues. EJScreen uses census tract-level data, which may not fully reflect the complexities of smaller neighborhoods or the unique challenges specific groups face within a community [1]. As a result, while it can provide a high-level overview of environmental justice concerns, it may not always capture localized risks or emerging environmental issues that are not well-documented or regulated.

Additionally, EJScreen's reliance on census data can be particularly problematic in areas where data may be outdated, incomplete, or not accurately reflect the current demographic and environmental landscape. This is especially true for Native American lands, where census data may be insufficient or inaccurately reported, as highlighted by Mullen and colleagues (2024) [1]. In these cases, relying on national datasets may not provide a complete or accurate picture of environmental and health risks. To address these limitations, communities must supplement EJScreen findings with local datasets and participatory data collection methods. Using locally gathered data can provide a more accurate understanding of environmental challenges specific to a region, allowing communities to identify risks that broader, national-level tools may not capture.

Despite these limitations, EJScreen can serve as a starting point for community-driven research and advocacy, especially for communities lacking the resources or expertise to conduct their own extensive environmental monitoring. For students, educators, and community members engaged in science education, we stress the importance of data literacy, enabling users to understand, interpret, and act on environmental data in meaningful ways. By helping communities engage with this data, EJScreen fosters both scientific understanding and empowerment. However, it is essential to note that to truly address the specific needs of local communities, science

education and literacy must go beyond just using tools like EJScreen. We encourage communities to complement these findings with localized research, participatory data collection, and collaborations with local organizations, academic institutions, and governmental agencies. By building capacity for deeper scientific inquiry and local data engagement, communities can enhance their understanding of environmental risks and make informed decisions that support environmental justice.

### **Conclusion**

This case report illustrates the potential of the EPA's EJScreen tool to highlight environmental injustices and serve as a critical component in science education and community engagement for positive change. By enabling communities to pull and analyze their environmental data, EJScreen offers a unique opportunity for residents and students to interact directly with data and better understand the disparities affecting their neighborhoods. For Buffalo's East Side, this tool revealed significant environmental risks, including elevated lead exposure, hazardous waste proximity, and high levels of traffic-related pollution. These issues, which disproportionately affect marginalized communities, were laid bare in a way that fostered informed, localized conversations about environmental justice. However, while EJScreen provides a wealth of valuable data, interpreting this data requires a broader understanding of the community's history, socio-economic context, and the lived experiences of its residents. The environmental disparities revealed through our use of EJScreen on Buffalo's East Side are deeply tied to a legacy of industrialization, systemic disinvestment, and persistent environmental neglect. To truly understand what the data tells us, it is essential to connect it to the historical and systemic practices that have shaped these conditions. This is a necessary aspect of data literacy, not just pulling the data but interpreting it within the context of community knowledge and history.

This interpretation is for drawing actionable conclusions and fostering meaningful change. For example, the data on pollution levels such as particulate matter (PM2.5), nitrogen dioxide (NO2), and sulfur dioxide (SO2) may reveal high exposure, but understanding how these pollutants interact with the community's geography, infrastructure, and socio-economic conditions allows for a more comprehensive analysis of the problem. Community members familiar with local issues, such as the presence of industrial sites, transportation corridors like the Kensington Expressway, or lack of green space, are better equipped to interpret these findings and advocate for solutions. Integrating this approach into science education can enhance students' ability to interpret environmental data critically, making them more critical thinkers and more informed and engaged citizens. Through hands-on workshops and presentations that allow students and residents to explore local environmental data, EJScreen fosters a sense of empowerment, illustrating how scientific tools can be applied to real-world problems. It bridges the gap between data and action, enabling students to understand how the environment impacts their health and community while giving them the tools to advocate for change.

While EJScreen is a powerful tool for identifying and analyzing environmental risks, its true value lies in how it helps communities and students interpret these risks within their own experiences and history. By fostering data literacy and

connecting data interpretation to community knowledge, we empower individuals to take action in informed, relevant, and impactful ways. This approach drives systemic change and creates a foundation for building a more resilient, equitable, and informed community, with science education playing a central role in making that change possible.

## References

1. Mullen, H., Whyte, K., & Holifield, R. (2023). Indigenous peoples and the Justice40 screening tool: Lessons from EJSCREEN. *Environmental Justice*, 16(5), 360–369. <https://doi.org/10.1089/env.2022.004>.
2. Miles, M. L., Haq, K. S., & Shippens, E. (2021). “Hey, I Live There!”: Unpacking Environmental Justice Education and Whiteness in a Rust Belt City. In *Unhooking from Whiteness* (pp. 162-179). Brill.
3. EPA EJScreen. (2023). *Environmental justice screening and mapping tool*. U.S. Environmental Protection Agency. <https://www.epa.gov/ejscreen>
4. Kuonen, J., & Miles, M. L. (2024). An environmental justice mapping tools guide to understand available resources to increase access. *Environmental Justice*, 17(5), 324–327.
5. Kurupparachchi, L. N., Kumar, A., & Franchetti, M. (2017). A comparison of major environmental justice screening and mapping tools. *Environ. Manag. Sustain. Dev*, 6, 59-71.
6. Taylor Jr., H. L., Jung, J. K., & Dash, E. (2021). *The harder we run*.
7. Williams, L. S. (1999). *Strangers in the land of paradise: Creation of an African American community in Buffalo, New York, 1900–1940*. Indiana University Press.
8. Ward, R. L., & Isiah, M. (2018). East vs. West: The industrious and inconsistent rising of Buffalo, New York. In *# Broken Promises, Black Deaths, & Blue Ribbons* (pp. 13–17). Brill.
9. Blatto, A. (2018). *A city divided: A brief history of segregation in Buffalo*.
10. Chakraborty, J., Maantay, J. A., & Brender, J. D. (2011). Disproportionate proximity to environmental health hazards: Methods, models, and measurement. *American Journal of Public Health*, 101(S1), S27–S36. <https://doi.org/10.2105/AJPH.2010.300111>
11. Erie County Department of Health, City of Buffalo. (2021). *Health equity report 2021*. Erie County, NY.
12. Erie County Department of Health. (2022). *Erie County, NY community health assessment: Community health improvement plan 2022–2024*.
13. Haq, K., Miles, M., & Ditto, A. (2024). Tuscarora nation lands and the New York State Power authority: an environmental justice education approach to decolonizing curriculum. *The Journal of Environmental Education*, 1-13.
14. Krieg, E. J. (2005). Race and environmental justice in Buffalo, NY: A ZIP code and historical analysis of ecological hazards. *Society and Natural Resources*, 18(3), 199–213. <https://doi.org/10.1080/08941920590901517>
15. Osakwe, N. C., Motsinger-Reif, A. A., & Reif, D. M. (2024). Environmental health and justice screening tools: a critical examination and path forward. *Frontiers in Environmental Health*, 3, 1427495.
16. Miranda, M. L., Edwards, S. E., Keating, M. H., & Paul, C. J. (2011). Making the environmental justice grade: the relative burden of air pollution exposure in the United States. *International journal of environmental research and public health*, 8(6), 1755-1771.
17. Taylor, H. L. (1991). African Americans and the rise of Buffalo’s post-industrial city, 1940 to present. *Journal of Urban History*, 17(3), 263–303. <https://doi.org/10.1177/009614429101700305>.

**Copyright:** © 2024 Miles ML. This Open Access Article is licensed under a [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.