SUMMARY FOR POLICY MAKERS

2024 Urban Environment and Social Inclusion Index

URBAN ENVIRONMENTAL & SOCIAL INCLUSION INDEX

SAMUEL CENTRE FOR SOCIAL CONNECTEDNESS

DATA DRIVEN ENVIROLAB

Introduction

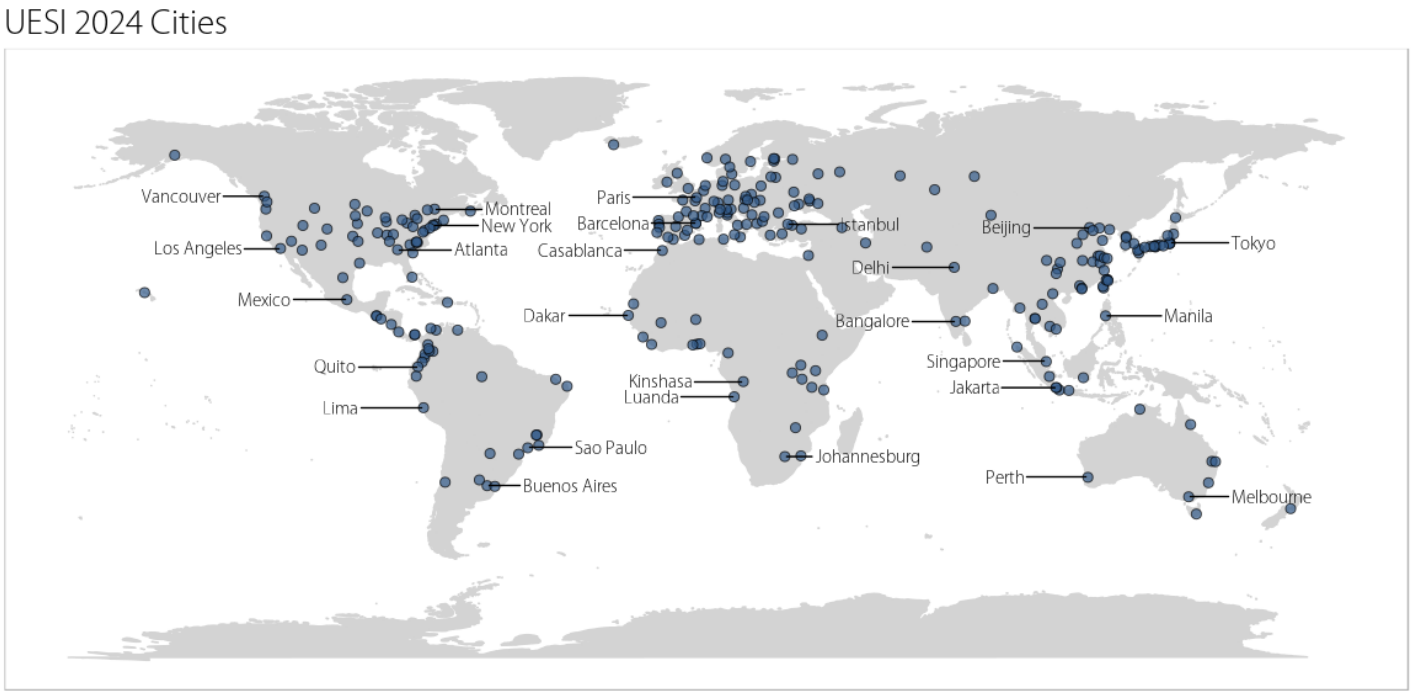

Figure 1. Cities evaluated in the 2024 UESI.

Cities are civilization's main stage: more than half of the world's population lives in cities, and that proportion is steadily increasing. As this shift occurs, policymakers and urban residents must consider: **How can we develop and grow our cities to be more beneficial for human and environmental health?**

Despite this broad question, analyses of urban sustainability and equity are often sector-specific, regionally-focused and one-dimensional in scope.[1] In response to this knowledge gap, we have developed the Urban Environment and Social Inclusion Index (UESI), the first spatially-explicit tool that provides insights into city environmental performance and social equity at both the city and neighborhood scale. The UESI aims to help city leaders, practitioners, policymakers, and researchers track progress in making cities inclusive, safe, resilient and sustainable.

In our 2024 update, the UESI evaluates the sustainability and social inclusion of 275 cities and over 15,500 subnational districts globally. In response to the UN's call to make cities more resilient and sustainable[2] and recognizing the intersectionality of social inclusion and environmental sustainability, we evaluate seven key areas: Air Quality, Climate Change, Urban Heat, Water, Tree Cover, Transportation and Equity (see Figure 2). From Lagos to Tokyo to São Paulo, the UESI is a one-of-a-kind tool and research initiative that provides policymakers, citizens, and scientists with valuable information about urban sustainability in various states of economic development and regions around the globe.

1 Thomas, R., Hsu, A., & Weinfurter, A. (2021). Sustainable and inclusive–Evaluating urban sustainability indicators' suitability for measuring progress towards SDG-11. Environment and Planning B: Urban Analytics and City Science, 48(8), 2346-2362.

2 United Nations. (n.d.). Cities - United Nations Sustainable Development Action 2015. United Nations. https://www.un.org/sustainabledevelopment/cities/#:~:text=Goal%2011%20is%20about%20making,half%20living%20in%20urban%20areas.

Figure 2. UESI 2024 Framework including the indicators for each component.

This policymakers summary presents the key findings of our 2024 UESI, including the progress cities have made on environmental performance and equity since 2019. We find that while many cities have strong environmental performance, more than half of the UESI cities are failing to achieve these results in an equitable way, disproportionately burdening less affluent citizens with poor environmental quality. Forty-four cities are also grappling with higher-than-average income inequality,[3] which places a dual burden on these cities' less affluent residents, who have less capacity to manage adverse environmental conditions.

3 Further information about each indicator's data sources, methods, and other details are accessible through our online portal (www.datadrivenlab,org/urban) and in forthcoming academic literature.

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Key Findings

01 *Top-performing cities excel across all categories, especially in climate emissions and air quality indicators, and are mainly in Europe. Lower-performing cities, often in Asia and South America, particularly China, struggle with PM2.5 pollution and urban heat indicators.*

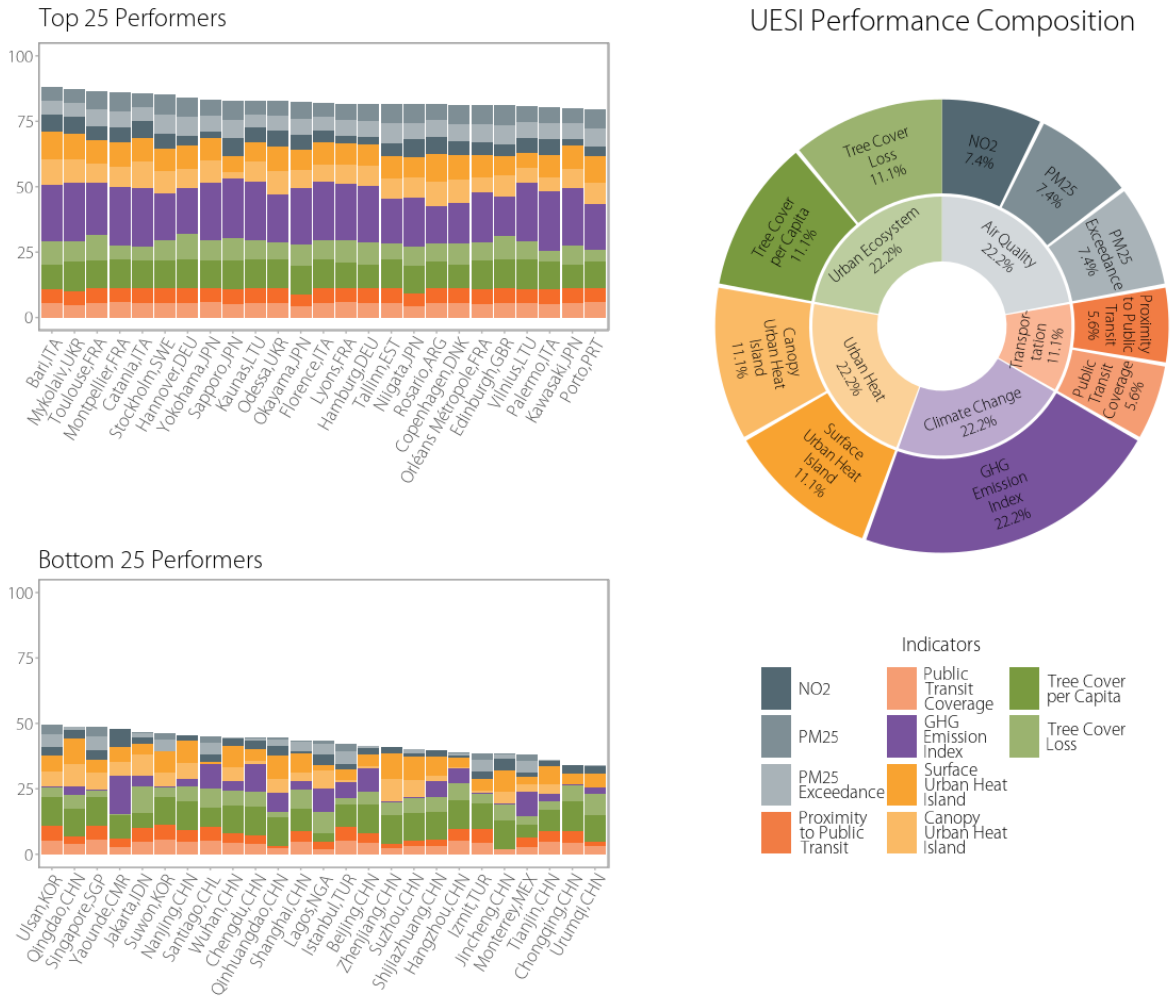

Figure 3. a) Top 25 and **b)** Bottom 25 UESI cities by weighted average environmental performance. Each bar indicates the contribution of each indicator to the total UESI Performance Score.

To assess the environmental performance of cities, we evaluate five categories composed of ten total indicators: 3 for air quality (gray), 2 for public transit (orange), 2 for urban heat (yellow), one for climate change (purple) and 2 for green space coverage (green). For more details on how we calculated these aggregated scores, see the Methods section on the UESI's website.[4] which comprehensively explains how we determined city scores.

Top-performing UESI cities (Figure 3a) have consistently high scores in tree cover per capita,

4 https://datadrivenlab.org/urban/report/methods/

proximity to public transit, and fine particulate matter pollution (PM2.5) concentration, while there is more variation in their performance related to urban heat, tree cover loss, and nitrogen dioxide (NO2) concentration. Of the 25 top-performing cities, 19 are located in Europe and Central Asia, five in East Asia and the Pacific, and one in South America, while none is in North America and Africa.

Figure 3b shows there is more variation in the indicator scores of the bottom 25 cities in all categories and indicators. Among the bottom 25 performing cities, most of them are also located in East Asia & Pacific - including 15 cities from China - followed by 2 cities in Sub-Saharan Africa, 2 in Europe and Central Asia, and 2 Latin American cities. Across the board, low-scoring cities are struggling with PM2.5 exposure, GHG emission index, and urban heat, while performance varies widely for tree cover and public transit.

For example, Santiago, Chile and Istanbul, Turkey have very low UHI scores, indicating an immediate need to improve urban heat exposure management. By analyzing the data available for air quality indicators until 2019, it is evident that several Chinese cities such as Beijing, Wuhan, Suzhou, and Hangzhou have failed to provide their inhabitants with safe and clean air.

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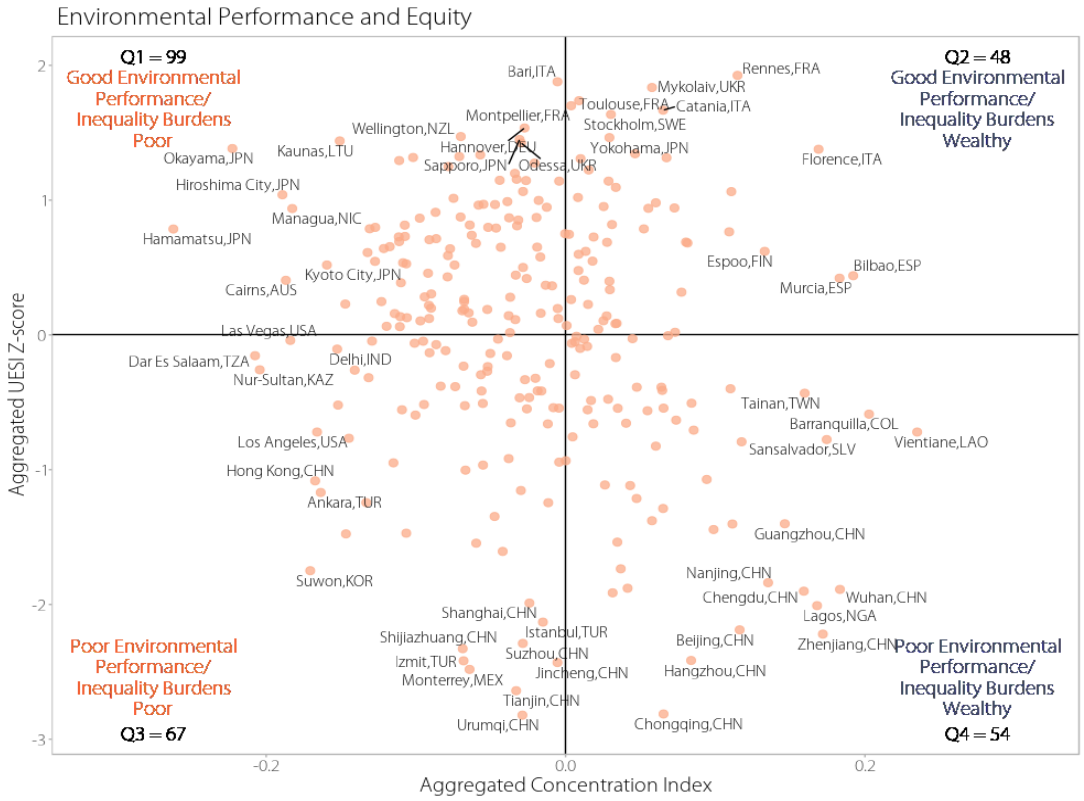


Figure 4. A four-quadrant plot examining the relationship between environmental performance (in terms of average z-score, indicating the distance from the mean for a city's performance on the UESI indicators) and equity (in terms of average concentration index). Label in each quadrant indicates the relation between both aspects. The number of cities located in each quadrant is signified in the corners of each quadrant.

02 *Despite Sustainable Development Goal 11's (SDG-11) charge for cities to be both sustainable and inclusive, cities are not sharing environmental benefits and burdens equally.*

While many cities perform well or above average on the UESI indicators, more than half of the UESI cities (166 out of 275) are failing to achieve these environmental results in an equitable way, disproportionately burdening less affluent citizens with poor air quality, exposure to urban heat, and lack of access to tree cover and public transport. As illustrated in Figure 4, the greatest number of cities are located in Quadrant 1 (99 or 36 percent), which indicates that environmental performance and equity are not necessarily concurrent, since these cities have better than average environmental performance but are still disproportionately burdening their less affluent citizens. Quadrant 3, where 67 (~24%) cities are located, shows an even worse scenario where poorer citizens disproportionately face more severe environmental outcomes in cities with already low environmental performance.

While improving environmental performance is desirable, it does not necessarily provide a more equitable environment, highlighting the need for cities and local governments to actively address issues of distributional equity as part of their environmental and development interventions. This condition is global, as we see that many cities in the US, Europe and Oceania are burdening their poorer residents.

03 *Wealthier cities tend to have better environmental performance compared to lower-income cities.*

When comparing economic development and environmental performance (UESI Score), some disparities are apparent. One third of cities (94 of 276), including many cities in North America and Europe, as well as some in Latin America and East Asia and the Pacific, are found in the upper right-hand quadrant of Figure 5, indicating a better-than-average environmental performance and higher-than-average levels of GDP. The lower left-hand quadrant, where both environmental performance and GDP are lower than the average, contains 51 cities in developing countries in East Asia and the Pacific, Middle East and North Africa, Sub-Saharan Africa and Latin America, such as Chengdu, China; Manila, Philippines; Johannesburg, South Africa; Lagos, Nigeria; and Lima, Peru.

Figure 5 shows that paradoxically, some (56) cities including Singapore, Paris, Sydney and Los Angeles have higher than average GDP and lower than average environmental performance. Similarly, 40 cities including San Jose, Rosario, Lome and Nairobi have lower than average GDP and higher than average environmental performance.

This pattern indicates that the relation between economic development and environmental performance at an urban level is not exclusively positive and is likely affected by additional factors such as urban planning practices, policy measures, and the economic and productive landscapes of each city.

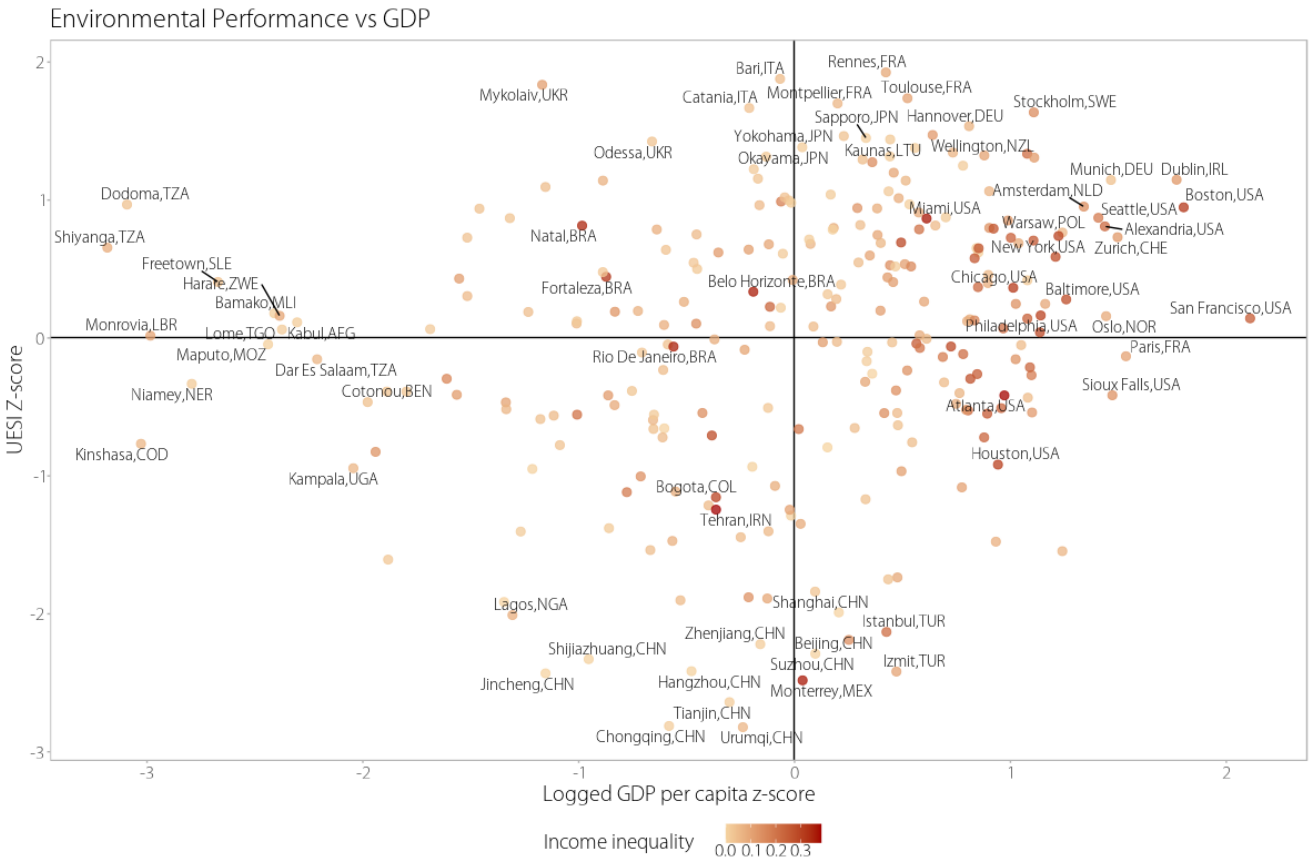


Figure 5. A four-quadrant plot examining the relationship between environmental performance (in terms of the z-score, or distance from the mean) and a z-score of logged income across all city neighborhoods. Cities are shaded according to their income Gini coefficient, a measure of income inequality within the city. Those cities with higher levels of income inequality are darker, while those less unequal are shaded lighter.

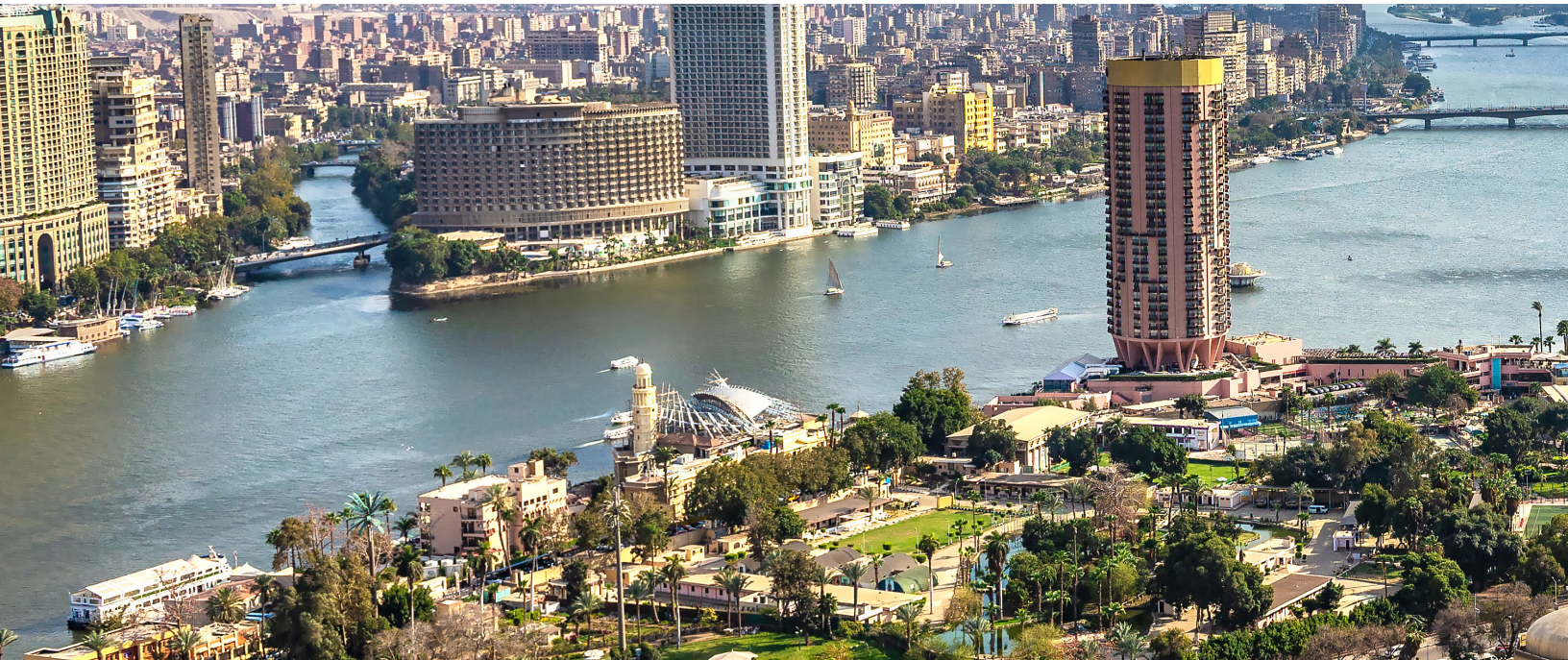
04 *Unequal distribution of environmental benefits and hazards exacerbates the unequal income distribution in ~50% of the global cities included in the UESI.*

We found that 166 UESI cities (left-hand quadrants in Figure 6) allocate environmental outcomes so the less affluent populations are affected by higher negative environmental conditions (i.e PM2.5) or have less access to positive ones (i.e Treecover). On the other hand, 102 cities (right-hand quadrants in Figure 6) allocate their environmental outcomes so the more affluent populations are exposed to higher negative environmental conditions or have less access to positive ones.

In addition, 43 of the cities allocating their outcomes to the less affluent citizens also show higher than the average income inequality. This disparity creates conditions where existing income inequality is exacerbated by environmental inequality, applying an additional burden for the less affluent to bear (lower left-hand quadrant). Cities throughout the globe are included in this quadrant but this insight is particularly relevant for North America, which has ~ 30 cities generating an undue environmental burden on less affluent residents.

While the lower left-hand quadrant of Figure 6 represents the most stark condition for the interaction of environmental inequity and income inequity, it should be noted that the higher left-hand quadrant, which includes 123 cities (~ 45%), also represents a situation where the burden of environmental inequalities is placed on the less affluent, even if the income inequality is less severe. This last quadrant includes cities from around the globe such as Merlbourne (Australia), Vancouver (Canada), Ulsan (Korea), Paris(France) and Betim (Brasil). On the other hand, as previously mentioned, the cities in the right-hand quadrants in Figure 6 are those where wealthier populations bear the brunt of environmental outcomes.

Finally, it is important to note that these results are sensitive to the availability of income data (see Methods). Due to the use of globally-available GDP-proxy data for income, the calculations of both the Gini Index and the Concentration Index for cities lacking self-reported district-level income data show less within-city variability than income, which leads to a possible underestimation of real inequality for those cities (see further details in the Methods).



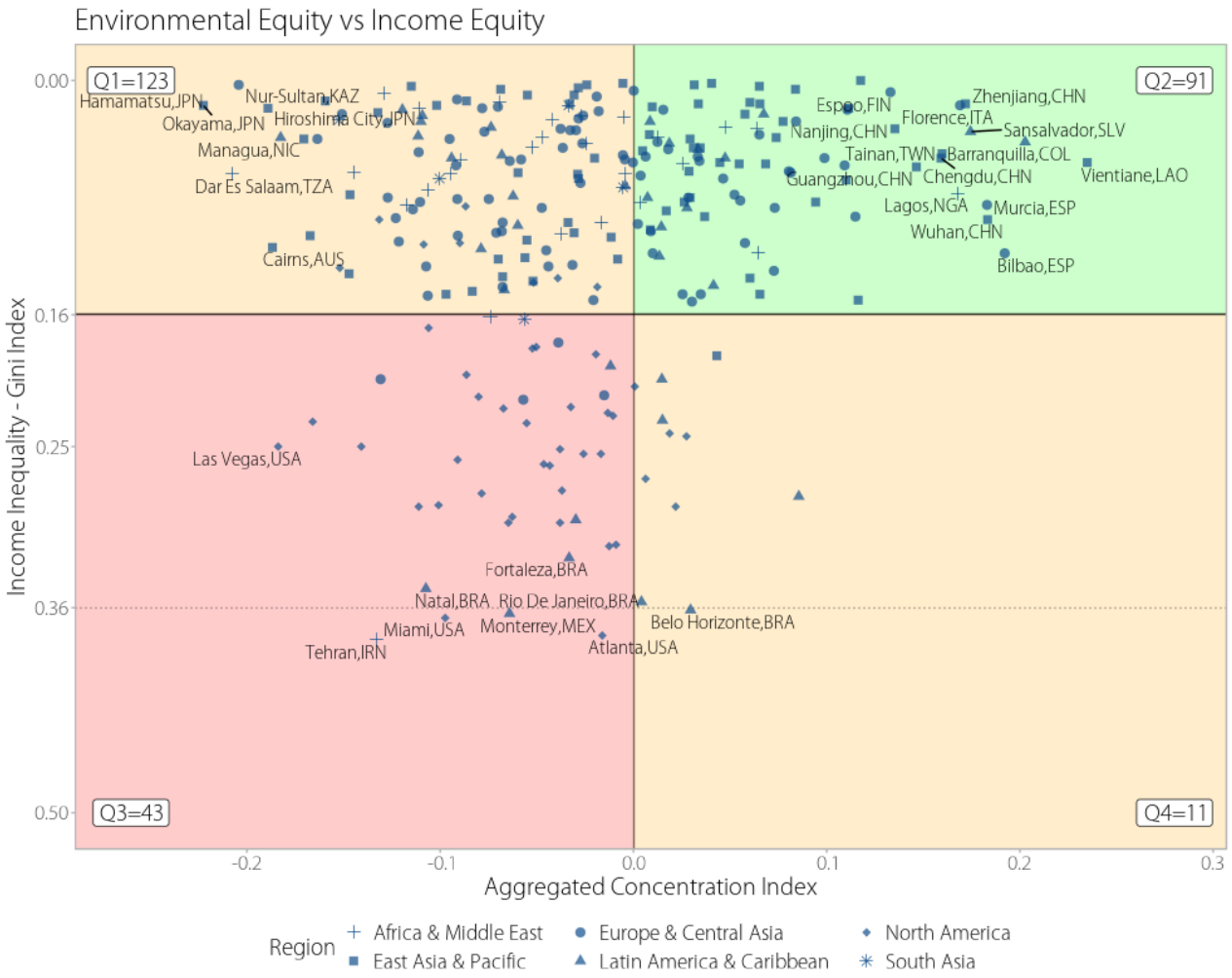


Figure 6. A four-quadrant plot examining the relationship between the aggregated Concentration Index for environmental inequality and the Gini Index for income inequality. The quadrants are created using the 0 value of environmental inequality, which represents perfect equity in the different environmental outcomes, and 0.16 as the average income inequality. Gini value of 0.36 is the average country Gini index from the World Bank. The number of cities located in each quadrant is signified in the corners of each quadrant (i.e., Q1=123; Q2=91; Q3=43; Q4=11).

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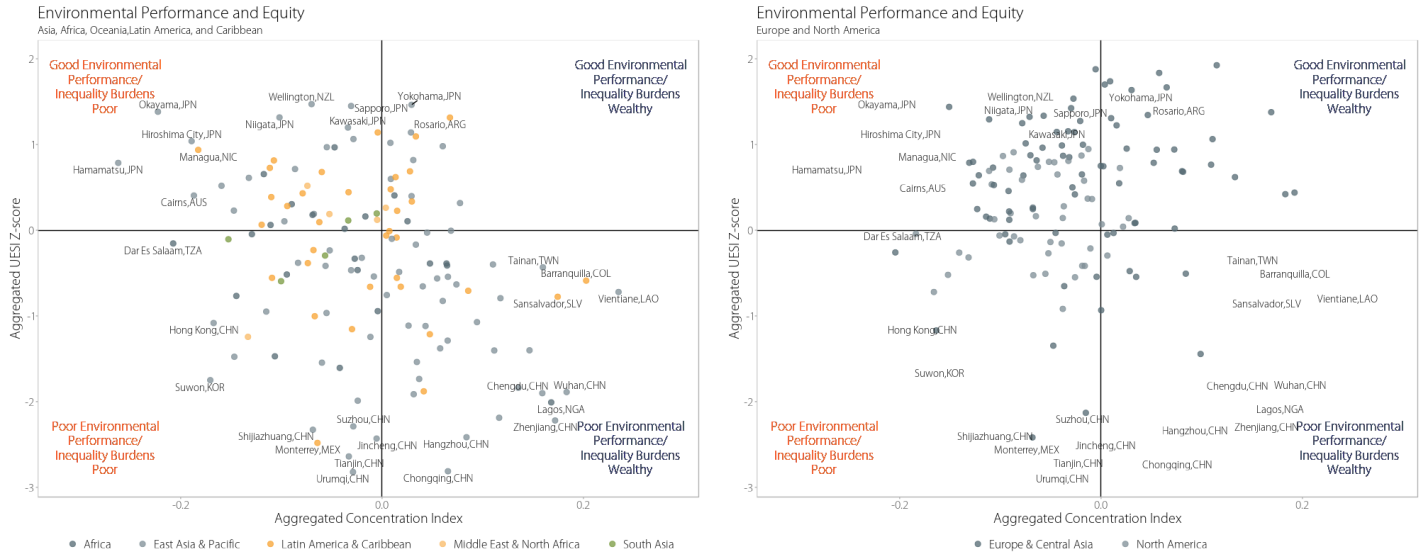
05 *Global divide: >50% of European and North American cities perform above average, while larger shares of cities in Asia and developing countries perform below average.*

Overall, UESI cities perform well on the environmental issues evaluated. A majority of UESI cities (53%, or 147 out of 275) perform above average on environmental indicators like air pollution, urban heat, GHG emissions, tree cover, and public transit access. However, performance varies between regions with a clear divide between developed and developing regions.

Well over half of UESI cities located in Europe and North America perform above average on environmental indicators - 25 cities in North America and 65 cities in Europe. In Asia, 26 out of 80 cities included in the UESI perform below average, signaling there is more room to improve. However as can be seen in both plots there is high variability on the average concentration index, highlighting that no region shows a consistently equitable distribution of their environmental outcomes.



Figures 7a and 7b. The four-quadrant plot from Figure 4 is reproduced into two splits here, with more developed, western cities in Europe and North America plotted in Figure 7a on the left, and less developed, eastern cities plotted in Figure 7b on the right. Individual continents are indicated by the color of the data point.

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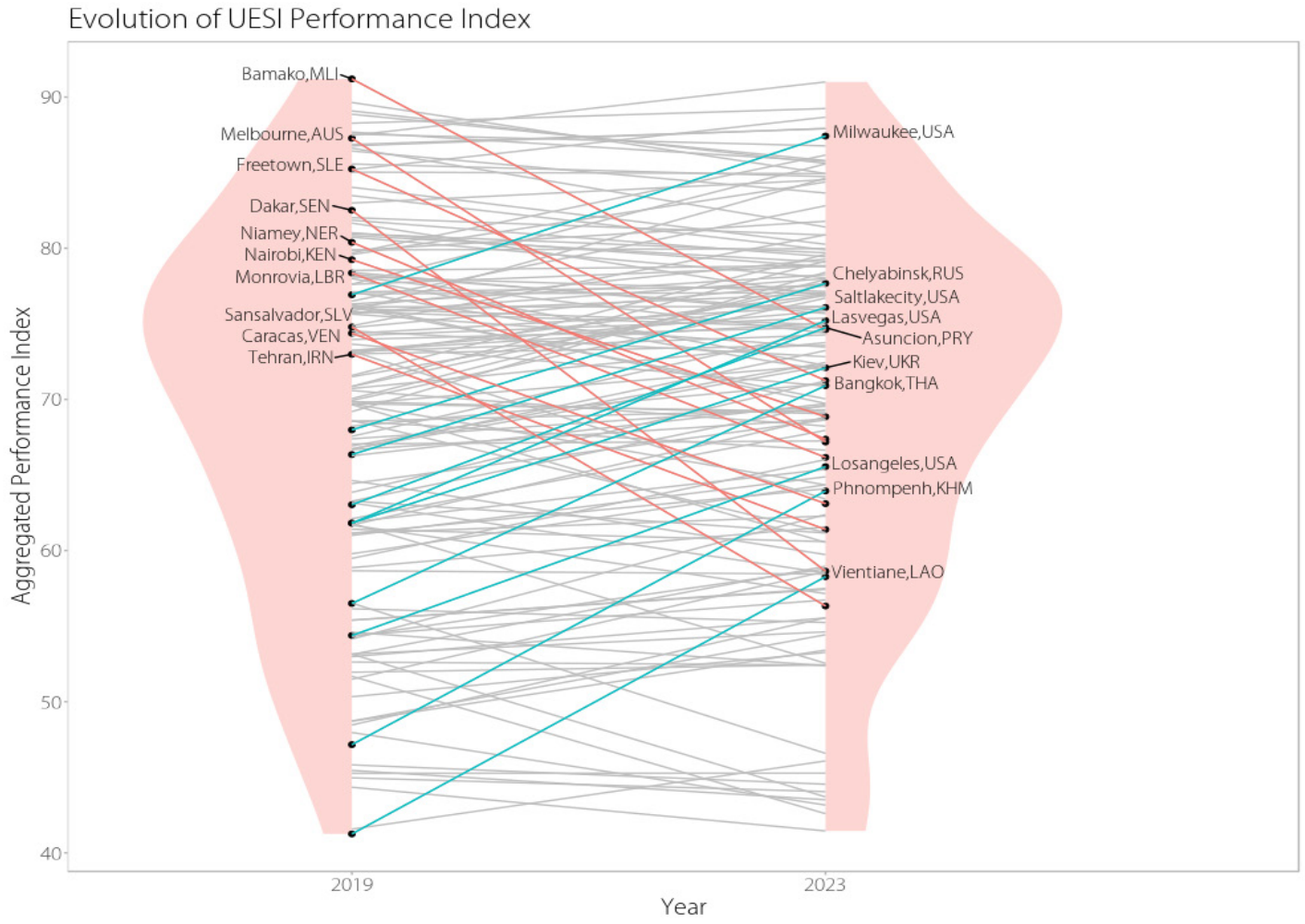
06 *Environmental performance and equity have stalled between 2019 and 2024.*

Leveraging the results of the 2019 and 2024 UESI, we analyzed the changes between the UESI Performance Index and Concentration Index for both years. Overall, when comparing the results on environmental performance for the cities analyzed in both 2019 and 2024, we found that the overall distribution and median value have not seen a significant change since 2019. This result suggests that we are not seeing a significant improvement in environmental performance for the majority cities in the UESI. However, there are individual cities that have seen an improvement in their performance index, like Las Vegas (USA), Asuncion (PRY) and Bangkok (THA). Others, like Melbourne (AUS) and Bamako (MLI) have seen their performance decline.

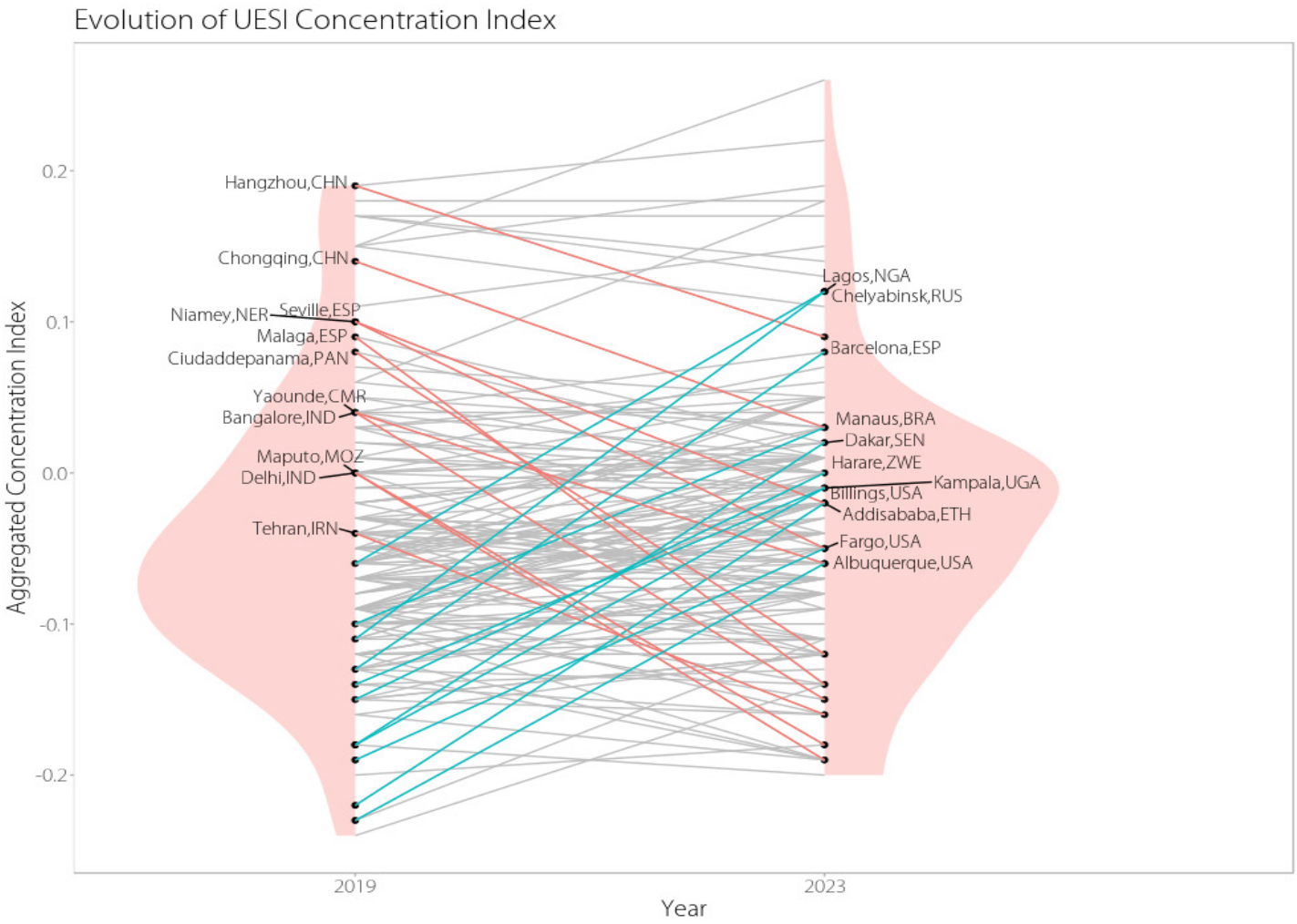
Similarly, while there are some differences in the distribution, UESI cities have not seen a significant change in their average Concentration Index between 2019 and 2024, suggesting the lack of an overall improvement in the equitable distribution of environmental benefits and hazards. Similar to the previous case, there are specific cities that have seen equity improvements, like Manaus (BRA) and



Figures 8a. The distribution and trend of UESI cities' on environmental performance between 2019 and 2024.

Albuquerque (USA), whereas some have become less equitable, like Delhi (IND) or Hangzhou (CHN).

The lack of an overall positive trend for both performance and equity metrics in UESI cities indicates that progress stalled between 2019 and 2024. These findings highlight the need for cities to intensify their efforts to provide healthier and safer environmental conditions for their citizens while taking actions to promote equity and justice.



Figures 8b. The distribution and trend of UESI cities' equity performance between 2019 and 2024.

Contact Us

The UESI is a research initiative developed by Data Driven EnviroLab from the University of North Carolina at Chapel Hill, freely available through a web portal.

Interested policy makers, cities and researchers can contact us through our website - https://datadrivenlab.org/urban/

About Data-Driven EnviroLab

The Data-Driven EnviroLab (DDL) is an interdisciplinary and international group of researchers, scientists, programmers, and visual designers. The DDL uses innovative data analytics to distill signals from large-scale and unconventional datasets and develop policy solutions to contemporary environmental problems. Working with scholars and policymakers across the globe, the DDL strives to strengthen environmental policy at all levels. We promote evidence-based approaches to problem-solving while boosting information disclosure and transparency among public institutions, private companies, civic organizations, and individual citizens.

The DDL is based at the University of North Carolina Chapel Hill and is a joint initiative between the Department of Public Policy , the Environment, Ecology, and Energy (E3P) Program, and the Institute for Environment at UNC. As an academic research lab headed by Angel Hsu, Assistant Professor at UNC-Chapel Hill, we have a particular mission to help train data-minded scholars and leaders in the field of environmental policy.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