

“How Will Our Planet Accommodate the Mobility Needs of 8 Billion People?”

Full Report
Advancing Lifestyle and Social Mobility Needs
in a Planet of 8 Billion People

Co-authors: Abby Despres, Mariama Fatajo, Molly Finch, Meron Hagos. Daniela Jurado, Victoria Melbourne, Nneamaka Jennifer Omo, Samuel Siaw, Oliver Torres, Amanda Yu

Team advisor: Joel Cutcher-Gershenfeld

Together, we are the Freedom of Mobility Team from Brandeis University’s Heller School for Social Policy and Management

Table of Contents

I. Executive Summary	2
II. Introduction	3
III. The impacts of modes of mobility on lifestyle	3
IV. Drivers of mobility inequity	5
Geographic Inequality	5
Urbanization Inequality	5
Socioeconomic and Wealth Inequality	6
Racial Inequality	7
Gender Inequality	7
Aging Inequality	8
Disability Inequality	8
Workforce Inequality	9
V. Pathways for mobility equity	10
Invest in Equity	10
Design for Justice	10

Create a Culture of Sustainability	11
Enable Climate Migration	11
Leverage Technology	12
VI. Conclusion	12
VII. Definitions	14
VIII. References	15

I. Executive Summary

The Heller School of Social Policy and Management at Brandeis University, situated in Waltham, Massachusetts, USA, is committed to using knowledge to advance social justice. It is with this commitment in mind that we explore how our planet can accommodate the mobility needs of 8 billion people. In a world facing scarcity of resources, where lifestyle is questioned and challenged, impacting mobility of people and goods, how can we ensure equitable distribution of wealth, opportunities, and privileges?

This exploration examines three critical modes of mobility: physical, social, and climate-driven. These modes shape the ways that individuals connect with resources and opportunities, creating avenues essential for inclusive societies worldwide. It also considers eight primary drivers of inequality in the context of these modes of mobility. These inequalities span geographical, urbanization, socioeconomic, racial, gender, aging, disability, and workforce domains. These drivers echo the diverse challenges encountered by communities worldwide in achieving equitable access to mobility.

To address the inequalities to meet the mobility needs of our planet, we point to five pathways forward. We advocate for the following actions:

- Invest in Equity
- Design for Justice
- Create a Culture of Sustainability
- Enable Climate Migration
- Leverage Technology

We seek to transform mobility into resilient, fair, and universally accessible avenues, resonating with our diverse global society.

Encompassing our Heller School's commitment to social justice, these equity-driven strategies transcend borders and embrace diverse cultures. Our research, addressing mobility disparities, paves actionable pathways, inviting every individual to partake in a more inclusive, vibrant, and equitable future.

II. Introduction

Humans are a mobile species. Our success across the planet has been a result of our ability to move from one environment to the next in search of opportunities and security for ourselves and our children. Today, we stand at a crossroads. Our current approach to mobility is harming the planet we desperately rely on and contributes to systemic inequality in our society. In this historical moment, how can we turn this crisis into a catalyst, fundamentally rethinking mobility in ways that reverse historical and extractive disparities and pioneer a better future for all? What does mobility equity look like for eight billion people and our planet?

Climate change, mobility, and societal inequalities are interdependent. Mobility disparities intersect with social issues, perpetuating existing inequalities. Race, gender, and socioeconomic divides are entrenched through transportation policies, hindering social mobility and economic prospects. There is an urgent need to reshape lifestyle and transportation choices to mitigate deteriorating climate change and alleviate societal disparities. Climate change compounds mobility inequalities and marginalized communities face a heightened burden due to environmental and social injustices. A multifaceted approach is needed to meet the mobility needs of the world's growing population, including addressing the drivers of inequity to chart a path forward.

III. The impacts of modes of mobility on lifestyle

Across every objective measure, the quality of life for people across the globe has improved over the last 200 years. Technological innovations were a large driver in improving living standards, transforming every aspect of our lives. This increased prosperity facilitated the ability for people to begin to craft their lifestyle offering them more mobility across several dimensions and as they became more physically and socially mobile, their prosperity grew. Sadly, this prosperity has not been equally available to all. Despite social policies that pushed for more equitable distribution of prosperity, systemic barriers restricted both social and physical mobility persist. In addition, this growth has been fueled by oppressive, extractive, and damaging practices, the legacies of which we grapple with today.

Social mobility offers opportunities for individuals to improve their socio-economic circumstances and is facilitated through access to education and better employment. Unfortunately, the opportunities to improve one's circumstances through these traditional means have become increasingly inaccessible. Physical mobility has experienced similar issues where persistent disparities in the access to and availability of transportation infrastructure reinforce stark inequalities. The World Bank highlights that inadequate transportation infrastructure limits access to education, healthcare, and economic opportunities, further perpetuating inequalities and losses in social mobility (Mikou et al, 2019).

A lack of transportation options not only limits economic opportunities but also health and well-being. An estimated 45% of the global population faces challenges accessing essential healthcare services due to transportation limitations (United Nations Development Programme, 2022) and over 1 billion people lack access to all-weather roads, significantly hindering mobility and perpetuating societal disparities (Mikou et al, 2019). Even for those who have access to personal

vehicles, studies suggest that for every additional 10 minutes spent on daily commutes, there's a notable decrease in individuals' happiness and life satisfaction (INTRIX, 2022; Kahneman et al., 2004).

On the other end the spectrum are the ultra-mobile, a group of individuals whose mobility choices give them global access to the best opportunities, further reinforcing their wealth and privilege (Kirmizi, 2023). The resource-intensive lifestyles and mobility choices of a privileged minority are significant contributors to climate change; moreover, the consequences are disproportionately felt by the less privileged minority. The lifestyle aesthetics of developed nations are also sought after as markers of “success” or the “good life,” and developing nations have sought to advance their economies by emulating that lifestyle. Regrettably, that “good life” is built on an extractive version of capitalism powered by fossil fuels and is a significant contributor to our current climate crisis (Xia et al., 2022).

Without meaningful access to true social mobility, the symbols of an upwardly mobile lifestyle are held up as desirable and have created an unsustainable culture of consumption. Success is too often measured by physical goods like the cars we drive. The global transportation system currently accounts for approximately 20% of global carbon dioxide emissions, with nearly half of that due to passenger vehicles (Ritchie & Roser, 2023). Electric vehicles and other alternative powertrain technologies offer significant emission reductions, but the choice to transition to these new technologies is only accessible to a select few (Heineke et al., 2023). Additionally, there are other societal costs associated with personal vehicles that extend beyond the resources they are made from, including consuming space, public resources, time, health, and safety (Shutkin & Bush, 2022; Spielmaker, 2023).

Currently, developed nations are demanding that developing nations curtail their pursuit of this lifestyle and cut their dependence on fossil fuels, but are not themselves adjusting their own behaviors and consumption patterns sufficiently. Moreover, excessive consumerism and over consumption is promoted through media channels further compounding these challenges. There needs to be a global redefinition of success that is more generative so that individuals from all nations can have equal opportunities to thrive in their societies.

If we cannot find a way to make this change, we face calamitous consequences. Extreme weather events driven by climate change serve to disrupt transportation systems, limiting the movement of people and goods. Climate mobility has always been a natural reaction from humans in response to changing environmental conditions. Climate change is creating migration patterns, both voluntary and forced, at a scale never before seen (Newland, 2011; Szaboova & Colón, 2020). In environments with limited transportation, additional disruption magnifies challenges for vulnerable populations leaving some unable to escape the worst impacts of climate change while others will be forced from their homes (Szaboova & Colón, 2020). Climate change will serve as a multiplier driving further inequality and reducing mobility for billions of people (Szaboova & Colón, 2020).

IV. Drivers of mobility inequity

People around the world do not enjoy equitable access to mobility. As the climate transforms, the repercussions are also not equitable. The barriers that inhibit mobility are driven by structural and systemic inequalities in our society and further magnified through the intersection of identities and circumstances. Exploring the impacts of restricted social, physical and climate mobility across different drivers of inequality highlights a pattern of factors that manifest in unique and specific ways. These drivers are not mutually exclusive and often overlap to create intersections that further amplify inequality.

Geographic Inequality

Migration due to climate has always been a part of our human story. However, our climate crisis will create forcible displacement on a scale never seen. The Institute for Economics & Peace estimates that by 2050, 2.8 billion people will reside in countries facing severe ecological threats, with 1.1 billion of these people living in countries with low societal resilience (Institute for Economics & Peace, 2023). Climate change will inevitably impact the lifestyles and well-being of these individuals, and while some will live in communities that can develop mechanisms to cope, and others will have the resources to relocate to areas of their choosing, forced displacement will be the only option available to the majority (Adams, 2016).

How, when, and where these displaced people move is a function of the mobility options available to them; some carry deep and tragic risks while others offer safe voyage from harm. One such example is in Latin America, where thousands of people each month risk their lives to cross the Darién Gap between Colombia and Panama to reach the Southern US border (Roy, 2022). They have been forced to traverse this remote and roadless crossing due to international crackdowns on migrations via sea and air (Roy, 2022). Despite this risk, the numbers of people attempting to make this journey continue to grow and this trend will only increase as climate change creates more displacement. The options available reflect the structural and systemic opportunities or inequities in our society. Where these migrants can move to is also of significant concern, currently, there is no recognition under international law (Bergeron, 2023) for climate migrants limiting their ability to cross borders to seek refuge. A globally coordinated effort to ensure equitable resource allocations for climate adaptation and realistic planning for displacement due to climate change is urgently needed.

Urbanization Inequality

Economic development is a crucial indicator of quality of life (Kaiser & Barstow, 2022) and often plays a significant role in mobility gaps between rural and urban areas. Globally, it's estimated that 60% of people experiencing poverty will live in rural areas by 2025 (Peng et al., 2023). Significant economic shifts towards the service and industrial sectors have been significant drivers of urbanization, drawing people from rural areas in search of economic opportunities (Barnett & Adger, 2018). Resource shortages, droughts, economic downturns, and wars disproportionately impact rural communities, and climate change will amplify the effects of these events (Peng et al., 2023). Climate change continues to affect agriculture, water availability, health issues, and living conditions as a whole, and rural communities will struggle to adapt without meaningful investment in mitigation (Hunter, 2007). Rural communities are often more isolated and, therefore, more susceptible to climate-induced transportation disruptions and delays in receiving support services (United States Environmental Protection Agency, 2022).

As these rural communities empty, the lower population density makes them a lesser priority for public service funding and economic investment, perpetuating a cycle of deprivation and depletion. Additionally, due to a lack of meaningful transportation alternatives, 91% of transport in rural areas is made by personal vehicle (Cohen, 2019).

While rapid urbanization has been damaging to rural communities, it has translated into an increased quality of life for millions of people. However, this improved quality of life has been powered by fossil fuels and driven a significant increase in carbon emissions. While urban settings tend to have better access to transportation alternatives, the primacy of personal vehicles persists there too. Urban settings need better transportation infrastructure to ensure we can continue to maintain these quality-of-life improvements and prevent rural communities from bearing the worst impacts of the climate crisis. The recent launch of an electrified bus rapid transit system in Dakar, Senegal offers a glimpse into how rapidly urbanizing areas can leapfrog current transportation paradigms to more sustainable, accessible transportation options (Chen, Diagana & Sergio, 2023). Dakar is one of the fastest growing cities in the African continent so this example, while promising, does still perpetuate the divides between urban and rural communities. Transition to alternative fuel sources is inhibited by a lack of supportive infrastructure and perpetuates an urban/rural divide in lifestyle.

Socioeconomic and Wealth Inequality

Addressing mobility inequity means understanding its underlying social and economic causes. One's socioeconomic status (SES) often determines one's health, education, and wealth. Social mobility is the ability of an individual to improve their SES or the SES of their children. Unfortunately, because of systemic barriers, low SES individuals have fewer opportunities for upward social mobility resulting in a growing gap in wealth and opportunity in our society.

People who have low SES tend to live in neighborhoods without meaningful transportation options that would connect them to economic or educational opportunities, and consequently, they are forced to spend longer commuting or are restricted in the opportunities available to them. (Kasu & Chi, 2019). The mass redevelopment of the transportation system in Bogotá, Colombia offers a glimpse into how access to mass transportation can begin to address socioeconomic inequality (Bocarejo & Urrego, 2022). While transportation within the city is challenged by rapid urban expansion, the time-burden on low-income people is significantly lessened thanks to the availability of accessible public transit (Bocarejo & Urrego, 2022). On the other hand, higher SES individuals are afforded more choices for their mobility and often live and work in areas with more transportation options and are afforded greater freedom of mobility to live or work in areas of their choosing.

The lifestyles of these higher SES individuals are also responsible for a disproportionate share of energy consumption and greenhouse gas emissions but afford them the ability to escape from the worst impacts of climate change (Nielsen et al., 2021). As these individuals accumulate wealth, they are also able to accumulate resources, leaving the rest of society behind. Climate change exacerbates existing inequalities, and the impact of a rapidly warming climate is more acutely experienced by lower SES individuals (Sullivan, 2021). Furthermore, their limited social and physical mobility means they have few options available to leave climate-deteriorated environments.

Racial Inequality

Race and mobility are inextricably linked. Racial inequality often reinforces mobility inequality and limits opportunities for racialized people to achieve a better quality of life. Though often recognized as essential in improving health and economic outcomes, inequitable mobility and restricted transportation stifle marginalized groups reinforcing ethnic and racial divisions.

In the USA, physical mobility infrastructure was constructed with the intent to limit the social mobility of non-whites. Several laws that limited the right to mobility served as a basis for discriminatory transportation, housing, and economic policies that have shaped the racial and political landscape to this day (Inwood et al., 2015). In a country where car culture dominates national culture, 90% of white households own at least one car compared to 73% of African-American households (Consumer Federation of America, 2017). This disparity stems from multiple factors, such as lower household income (Center, 2016), higher auto loan rates issued (Consumer Federation of America, 2007), and segregation in neighborhoods that do not historically have access to automobiles in the first place (Maclay, 2006).

Climate justice and racial justice are likely linked because historically targeted racial communities feel the disproportionate impact of these overlapping systems of oppression. Because of a legacy of colonial extraction and intentional exclusion, racialized communities are subjected to legacies of neglect and a lack of investment, leaving them more vulnerable to the impacts of climate change (Yeampierre, 2020). These communities lack the resources to mitigate against the worst harms of extreme weather events or the means to relocate when these events occur. Worse yet is the lack of reinvestment and recovery post-disaster leading to displacement and further reinforcing systemic inequalities.

Gender Inequality

While not as frequently discussed as other aspects of mobility inequity, gender divides exist in physical and social mobility. Physical mobility is often defined within the context of traditional gender roles, in which the feminine is associated with staying at home, and the masculine is associated with travel, public spaces, and the title of “breadwinner” (Hanson, 2010). As a consequence, the car and other transportation modalities have been historically associated with masculinity and the patriarchy and had limited female use before the Second World War (Walsh, 2007, 2008).

Women have vastly different and often more complex travel patterns than men, which is driven by their roles as caregivers (Foley et al., 2022; Muhoza et al., 2021). Unfortunately, their transportation needs have been largely ignored in the fields of transportation planning and policy (Muhoza et al., 2021). Additionally, issues of safety play a significant role in women’s experiences with alternative modes of transportation, limiting their freedom of mobility (Zukowski, 2022).

While the economic status of women has improved, women are also over-represented among low-wage workers, and these gaps are amplified when layered on with issues of race and ethnicity (Corbett, 2023). Women also hold fewer than 10% of governmental and organizational power positions (Wageni, n.d.). Patriarchal policies have kept women in poverty, enabled sexual harassment, and prevented strides in green technology that would close the gender mobility gap (Ceccato & Loukaitou-Sideris, 2022; Olson, 2020). In India, states are launching a program

called Shakti which provides free bus commuting for women to increase labor force participation (Sanjay, 2023). Unfortunately, harassment of women on public transportation in India continues to be a barrier to their mobility access (Sanjay, 2023).

Like other vulnerable groups, women - particularly women of color and low SES women - are at greater risk from the effects of climate change due to the barriers to mobility. Additionally, Pregnant women, along with young children, face disproportionate health impacts from climate change due to extreme heat, poor air quality, and novel infectious agents (Malasky, 2022; World Health Organization, 2023). Despite these barriers, women are also some of the most prominent voices fighting for meaningful action against climate change (Ainger et al., 2023).

Aging Inequality

People are living longer, and it is estimated that the percentage of individuals over 60 will increase from 12% to 22% by 2050, and that number will increase to 30% in developed nations (Lin & Cui, 2021). While the quality of life of older populations is improving, these benefits are not equally distributed. The inequities experienced throughout an individual's life compound over time. As an individual ages, the accumulated disparities become harder to change, which limits social mobility (Roig & Maruichi, 2023; Kaiser, 2009). Additionally, physical mobility can be reduced through disease and disability or through a loss of preferred transportation via personal vehicles. These mobility restrictions can significantly impact the health and well-being of people as they age, compounding issues of economic precarity, social isolation, and deteriorating health. In Nanjing, China policies have been enacted to create an environment to support growing ageing population (Chen et al. 2023). This urban renewal initiative supported ageing in place, facilitated enhanced mobility freedom and encouraged more home-based and community-based care for older individuals (Chen et al., 2023).

Limitations in mobility also compound vulnerabilities to climate change. Older people are especially vulnerable to weather-related hazards, and as climate change intensifies, this risk increases (Carter et al., 2016). Recent heat waves in Europe and North America have all been associated with excess deaths, particularly among the elderly (Treisman, 2023, Khatana, 2022), and a recent report from the Lancet estimates excess deaths across all ages from heat waves to increase by 370% by 2050 (Romanello et al., 2023). As with other vulnerable groups, the capacity to cope with these events is further eroded through substandard housing, isolation, poor access to or dependence on social or health services, and restricted mobility (Carter et al, 2016). The availability of safe, accessible and reliable alternative modes of transportation can serve to reduce these negative impacts along with programs and services aimed to address additional social factors that increase vulnerabilities.

Disability Inequality

People with disabilities experience immense barriers in their physical and social mobility. While legislation managing access exists in many developed nations, the lived realities for many with disabilities are one of frustration and exclusion as their mobility is constrained. For many who are disabled, driving a personal vehicle is not a viable alternative, and those who do drive often need specialized adaptations on their vehicles (Rosenbloom, 2007). Access to transportation alternatives varies by geography and, even when available, may not have the amenities to facilitate access for people with disabilities. Approaches to improve transportation accessibility have generally been piecemeal and have not addressed broader topics of urban design and

adaptive service delivery. Japan has leveraged its advanced technology to ensure accessibility across many public spaces and over the last decade has worked to improve access to barrier-free transportation (Richarz, 2022).

Higher incomes can mitigate against the worst effects of mobility exclusion; however, due to structural and systemic barriers, the poverty rate among people with disabilities is twice that of people without disabilities (Goodman, Moris & Boston, 2019). The relationship between poverty and disability is complex as people with disabilities are more likely to become impoverished, and poverty is a risk factor for acquiring a disability. Due to physical mobility restrictions and discrimination, people with disabilities are also less able to access economic and educational opportunities, limiting their social mobility.

The risks of climate change for people with disabilities have largely been ignored in the broader discourse (Engelman, Craig & Iles, 2022). Many people with disabilities experience economic and social marginalization, which alone puts them at greater risk of the impacts of climate change, and for those living in resource-poor nations or experiencing additional marginalized identities, the risks are amplified. In addition to the physical inability to leave an environment impacted by climate-driven disasters, people with disabilities will also experience disruptions in their access to medical care, home-based support, or other rehabilitative services. Additionally, they may also be more physiologically vulnerable to extreme heat, cold, or poor air quality, which can all serve to worsen their health and well-being. Planning alone will not be sufficient to address these risks and requires substantial shifts that address how people with disabilities engage with the world.

Workforce Inequality

The image of the digital nomad is the ultimate expression of freedom of mobility in the workforce, leveraging technology to work from anywhere for anyone at any time. This image hides the darker reality that the labor market is facing a crisis of mobility (Escobari, Seyal & Contreras, 2021). Improving one's economic outlook is a primary vehicle for social mobility. Unfortunately, the pathways to move from low to high-wage work have become scarce, resulting in a system that perpetuates social and economic disadvantages (Escobari, Seyal & Contreras, 2021). This restricted social mobility is exacerbated by restricted physical mobility. The freedom to choose where and how one gets to a job is a privilege, and for many low-wage workers, a lack of meaningful transportation options translates into a lack of meaningful employment options (Kirmizi, 2023).

The impacts of climate change are also unequally distributed in the workforce, such that individuals in the higher stratification can choose where they work and how they get to work so that they remain in protected environments, limiting their exposure and risk to extreme weather conditions (Applebaum et al, 2022; Kirmizi, 2023). Recent record-breaking heat waves and associated deaths have exposed the risks to workers and their work sites, and their means of transportation offer little to no protection against such extreme events while legislation fails to keep up with the changes in our environment. Across the USA, record-breaking heat is killing many outdoor workers. Protections like access to shade, frequent breaks, and drinking water are mobility concerns because deprivation of such protections can permanently impair workers (Applebaum et al. 2022; Chan, 2022).

The choices we make to transition our economy away from fossil fuels not only contribute to worker inequality but also an inequitable distribution of the benefactors of this transition (Hardman et al., 2021). The mining of rare earth minerals is associated with major human rights violations, and the manufacturing of some electric vehicles in countries with poor track records of human rights is of deep concern (Sadan et al., 2022; Worminton, 2022). Furthermore, those electric vehicles are only accessible to individuals with the economic means to afford them, further perpetuating presently existing transportation inequalities (Romero-Lankao, Wilson & Jimmy-Schmitt, 2022).

V. Pathways for mobility equity

Creating meaningful pathways that can improve social, physical and climate mobility requires collaborative and coordinated efforts across multiple sectors. Policy interventions, private sector innovation, and global cooperation are pivotal in shaping an inclusive mobility landscape but so too is grounding planning and interventions in the experiences and needs of communities most directly impacted mobility inequality. By acknowledging that the people who are most directly impacted by any change are the subject matter experts in their own lives, we can leverage their knowledge so we can better address a community's needs and ensure a more just society.

Invest in Equity

Without meaningful investment in mobility, people will remain trapped in cycles of deprivation, and the growing inequality in our society will worsen. This investment will require the redistribution of wealth to create more equitable mobility for all. To support investment in equity, we recommend:

- Invest in programs to address gaps in educational attainment at all stages of a person's life, including re-training for roles at risk of replacement from technology and innovation.
- Invest in climate mitigation approaches in high-risk communities to reduce the worst impacts of climate disruption and in communities that have experienced climate-driven disruptions to support recovery that addresses underlying vulnerabilities.
- Provide micro-financing or grants to vulnerable communities to invest in alternative forms of mobility.
- Shift how the business case is made for mass transportation and other mobility alternatives to support more equitable investment in mobility options, shift public preference away from the false convenience of personal vehicles to alternative modes of transportation, and support more mobility alternatives in vulnerable communities.

Design for Justice

The injustices of our society are not accidental, through intent and neglect, structural and systemic inequality exists in all facets of our society and intentional planning and design is needed to create more just systems. To address systemic injustice, we recommend:

- Adopt an equity lens for all aspects of policy and planning to understand the structural and system barriers to access services.
- Require inclusive, human-centric infrastructure design to prioritizes universal accessibility.

- Integrate natural systems into infrastructure design to promote a more harmonious existence with the environment and restore the mobility of natural systems such as migratory pathways, waterways, and air systems.
- Apply an equity lens to climate risk assessment and mitigation, working with communities to identify the capabilities they can leverage and vulnerabilities they need to address.
- Develop robust regulations to ensure workers are protected from the hazards of extreme weather events
- Require more transparency and ethical choices in global supply chains to better inform consumers and create accountability for unethical business practices linked to human rights and environmental harm.

Create a Culture of Sustainability

Currently, the dynamics of our economies demand maximized consumption and maximized profit. The fixation on this singular outcome contributes to our consumption culture, deep social inequity, and environmental harm. To support a shift away from consumption culture, we recommend:

- Empower communities with the means of production, facilitating the ability to obtain resources to manufacture and distribute goods locally to reduce their carbon footprint and create self-sufficiency.
- Develop policies to require more durable or repairable products that increase self-reliance and reduce carbon emissions from producing and transporting goods.
- Integrate robust materials, advanced engineering, and predictive maintenance technologies in manufacturing mobility products to minimize the need for frequent repairs and replacements, thus reducing consumption.
- Adjust business operations so that the supply chain, from obtaining raw materials to manufacturing and distributing goods to customers, addresses issues tied to human rights and environmental harm.
- Create marketing strategies to shift social norms and address root causes of excessive consumerism and overconsumption and promote more sustainable lifestyles.

Enable Climate Migration

Without the opportunity to migrate, populations are vulnerable to changing circumstances due to climate-related incidents that occur both over time and suddenly. Where these people go needs to be addressed. In order to reckon with climate displacement, we recommend:

- Adopt an equity-driven approach to climate-driven migration that leads to policies to protect and recognize migration due to climate change.
- Conduct risk assessment and mitigation in partnership with affected communities in order to meaningfully mitigate against the worst harms of displacement.
- Establish plans to safely move people out from disaster-affected regions with a particular focus on vulnerable members of the community who already lack access to safe mobility options and realistic plans for where and how climate migrants will move in the event of disruption.

Leverage Technology

Electric and autonomous vehicles, smart grids, and app-based services to connect multimodal transportation can contribute to reduced carbon emissions, enhance efficiency, and improve safety. To support these shifts in mobility, policymakers need to understand how to leverage technological innovations as tools to advance their mobility objectives, not drive their mobility objectives. To support a strategic approach to emerging technologies, we recommend:

- Create policies and regulations for robust data protection and cybersecurity to ensure the privacy and safety of users.
- Promote experimentation with new technologies to give communities the opportunity to assess the effectiveness of the technology and offer opportunities to update and adapt them as needs change.
- Apply an equity assessment to all emerging technologies and require that the companies address concerns over equity before allowing the technology to be used in a given jurisdiction.
- Build productive partnerships between private industry, nonprofit and government agencies to identify opportunities to leverage technology to address mobility challenges.

VI. Conclusion

The freedom of mobility should be available to all people equitably, but there are barriers to mobility that are difficult to overcome. Restrictions in physical, social and climate mobility deepened by disparities driven by geography, socioeconomic status, race, gender, age, and disability.

The absence of freedom of mobility can significantly impact an individual's life on multiple fronts. Without the ability to move freely, individuals face limitations in accessing education, job opportunities, and essential services, which constrains their economic and personal growth. Social interactions and cultural experiences are also restricted, affecting mental well-being and the development of diverse perspectives and networks. Lack of mobility can lead to isolation, hindering participation in community activities and limiting exposure to different environments, curtailing individual fulfillment and self-expression. Adaptation to a changing climate requires freedom of mobility as well and inequalities in society are being amplified by this crisis.

Solutions demand a holistic approach that creates pathways that promote equitable investments, address historic injustice, motivate sustainable culture shifts, reckon with climate-driven migration, and facilitate responsible technology use. Implementing policies that prioritize the needs of marginalized communities and addressing the barriers to lifestyle choices is essential to achieving true mobility freedom. By prioritizing mobility equity for all, we can work towards creating a more inclusive society where the world's eight billion people have equal opportunities to thrive today and tomorrow.

While our analysis has been thorough, there are many outstanding questions on how to support mobility equity that deserve exploration. The questions below are not an example of outstanding concerns but are not an exhaustive list.

- What are the best ways to support partnership and collaboration between government, non-profit and private industry to advance mobility equity across the globe?

- Given the existing incentives, is there a way for corporations to shift their marketing away from driving rampant consumerism and over-consumption?
- If the shift to electric vehicles is not sufficient to meet our global mobility needs, how can we shift social norms to prioritizing other forms of transportation?
- What responsibility do developed nations have to change their lifestyles, given their disproportionate contribution to climate change?
- For communities forced to relocate due to climate change, how can they protect and continue to access sites of cultural significance?

VII. Definitions

Climate Mobility: the ability of individuals or groups to move away to migrate away from an area or region to avoid changes in climate and can be proactive, adaptive, forced, or restricted. A lack of climate mobility negatively impacts health, safety and livelihoods.

Lifestyle: refers to the way individuals and communities will live, work, and interact in a world. It encompasses the daily routines, choices, and behaviors related to how people move and access services and opportunities.

Physical Mobility: the ability of individuals or groups to move within and between places and spaces and can be facilitated through a number of means such as walking, biking, driving, or public transportation. A lack of physical mobility inhibits access to employment, education, critical services and social connection.

Social Mobility: the ability of individuals or groups to move within or between social strata or classes in a society. A lack of social mobility hinders the ability to improve social status, wealth, education, occupation and or other factors determining someone's social position.

VIII. References

- Adams, H. (2016). Why populations persist: Mobility, place attachment and climate change. *Population and Environment*, 37(4), 429–448. <https://doi.org/10.1007/s11111-015-0246-3>
- Ainger, J., Sguazzin, A., Inglesias, S., Kavanagh, M.J., & Tetley, L. (2023, November 16). World Efforts to Stop Climate Change Are Being Led by Women. Bloomberg. <https://www.bloomberg.com/news/features/2023-11-16/world-efforts-to-stop-climate-change-are-being-led-by-women>
- Applebaum, K. M., Graham, J., Gray, G. M., LaPuma, P., McCormick, S. A., Northcross, A., & Perry, M. J. (2016). An Overview of Occupational Risks From Climate Change. *Current Environmental Health Reports*, 3(1), 13–22. <https://doi.org/10.1007/s40572-016-0081-4>
- Barnett, J., & Adger, W. N. (2018). Mobile Worlds: Choice at the Intersection of Demographic and Environmental Change. *Annual Review of Environment and Resources*, 43(1), 245–265. <https://doi.org/10.1146/annurev-environ-102016-060952>
- Bergeron, T. (2023, January 20). No Refuge for ‘Climate Refugees’ in International Law—Tyler Bergeron. Environmental, Natural Resources, & Energy Law Blog. <https://www.lclark.edu/live/blogs/200-no-refuge-for-climate-refugees-in-international>
- Bocarejo, J. P., & Urrego, L. F. (2022). The impacts of formalization and integration of public transport in social equity: The case of Bogota. *Research in Transportation Business & Management*, 42, 100560. <https://doi.org/10.1016/j.rtbm.2020.100560>
- Carter, T. R., Fronzek, S., Inkinen, A., Lahtinen, I., Lahtinen, M., Mela, H., O’Brien, K. L., Rosentrater, L. D., Ruuhela, R., Simonsson, L., & Terama, E. (2016). Characterising vulnerability of the elderly to climate change in the Nordic region. *Regional Environmental Change*, 16(1), 43–58. <https://doi.org/10.1007/s10113-014-0688-7>
- Ceccato, V., & Loukaitou-Sideris, A. (2022). Fear of Sexual Harassment and Its Impact on Safety Perceptions in Transit Environments: A Global Perspective. *Violence against Women*, 28(1), 26–48. <https://doi.org/10.1177/1077801221992874>
- Center, P. R. (2016, June 27). 1. Demographic trends and economic well-being. *Pew Research Center’s Social & Demographic Trends Project*. <https://www.pewresearch.org/social-trends/2016/06/27/1-demographic-trends-and-economic-well-being/>
- Chen, M., Bolt, G., Yu, L., & Hooimeijer, P. (2023). The impact of the residential environment on Chinese older people’s aging-in-place intentions: A mediation and moderation analysis. *Habitat International*, 140, 102908. <https://doi.org/10.1016/j.habitatint.2023.102908>
- Chen, Guangzhe, Diagnan, Ousmane, & Pimenta, Sergio. (2023, December 6). Five reasons to get excited about the Bus Rapid Transit in Dakar, Senegal. World Bank Blogs. <https://blogs.worldbank.org/voices/five-reasons-get-excited-about-bus-rapid-transit-dakar-senegal>

- Cohen, K. (2019). *Human Behavior and New Mobility Trends in the United States, Europe, and China*. Fondazione Eni Enrico Mattei (FEEM); JSTOR. <http://www.jstor.org/stable/resrep21774>
- Consumer Federation of America. (2017). *Consumer Expenditure Survey Data Reveal Disparate Racial Impacts Related To Auto Insurance*. https://consumerfed.org/wp-content/uploads/2017/06/Auto-Insurance-Disparate-Racial-Impacts_Report.pdf
- Consumer Federation of America. (2007, May 7). African-Americans Pay Higher Auto Loan Rates But Can Take Steps to Reduce This Expense. *Consumer Federation of America*. https://consumerfed.org/press_release/african-americans-pay-higher-auto-loan-rates-but-can-take-steps-to-reduce-this-expense/
- Corbett, H. (2023, August 30). Lowest Paid Workers In U.S. Are Mostly Women. Paying Them More Helps GDP. *Forbes*. <https://www.forbes.com/sites/hollycorbett/2023/08/30/labor-day-2023-how-paying-a-living-wage-can-contribute-to-gdp-growth/>
- Engelman, A., Craig, L., & Iles, A. (2022). Global Disability Justice In Climate Disasters: Mobilizing People With Disabilities As Change Agents. *Health Affairs*, 41(10), 1496–1504. <https://doi.org/10.1377/hlthaff.2022.00474>
- Escobari, M., Seyal, I., & Contreras, C. D. (2021). Moving up: Promoting workers' upward mobility using network analysis. <https://policycommons.net/artifacts/4145159/moving-up/4953970/>
- Foley, L., Brugulat-Panés, A., Woodcock, J., Govia, I., Hambleton, I., Turner-Moss, E., Mogo, E. R. I., Awinja, A. C., Dambisya, P. M., Matina, S. S., Micklesfield, L., Abdool Karim, S., Ware, L. J., Tulloch-Reid, M., Assah, F., Pley, C., Bennett, N., Pujol-Busquets, G., Okop, K., ... Randall, L. (2022). Socioeconomic and gendered inequities in travel behaviour in Africa: Mixed-method systematic review and meta-ethnography. *Social Science & Medicine (1982)*, 292, 114545. <https://doi.org/10.1016/j.socscimed.2021.114545>
- Goodman, N., Morris, M., & Boston, K. (2019). Financial Inequality: Disability, Race and Poverty in America. National Disability Institute.
- Hanson, S. (2010). Gender and mobility: New approaches for informing sustainability. *Gender, Place & Culture*, 17(1), 5–23. <https://doi.org/10.1080/09663690903498225>
- Hardman, S., Fleming, K. L., Khare, E., Ramadan, M. M., & Khare, S. H. K. L. F., and Eesha. (2021, August 20). A perspective on equity in the transition to electric vehicles. MIT Science Policy Review. <https://sciencepolicyreview.org/2021/08/equity-transition-electric-vehicles/>
- Heineke, K., Laverty, N., Möller, T., & Ziegler, F. (2023). The Future of Mobility in 2035 (McKinsey Quarterly). McKinsey. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-mobility-mobility-evolves>

- Hunter, L. (2007). *Climate Change, Rural Vulnerabilities, and Migration*. PRB.
<https://www.prb.org/resources/climate-change-rural-vulnerabilities-and-migration/>
 Institute for Economics & Peace. Ecological Threat Report 2023: Analysing Ecological Threats, Resilience & Peace, Sydney, November 2023. Available from:
<http://visionofhumanity.org/resources> (accessed 27 Nov 2023).
- INRIX. (2022). Global Traffic Scorecard. Inrix. <https://inrix.com/scorecard/>
- Inwood, J. F. J., Alderman, D., & Williams, J. (2015). “Where Do We Go From Here?”: Transportation Justice and the Struggle for Equal Access. *Southeastern Geographer*, 55(4), 417–433.
- Kaiser, H. J. (2009). Mobility in Old Age: Beyond the Transportation Perspective. *Journal of Applied Gerontology*, 28(4), 411–418. <https://doi.org/10.1177/0733464808329121>
- Kaiser, N., & Barstow, C. K. (2022). Rural Transportation Infrastructure in Low- and Middle-Income Countries: A Review of Impacts, Implications, and Interventions. *Sustainability*, 14(4), Article 4. <https://doi.org/10.3390/su14042149>
- Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method.
- Kasu, B. B., & Chi, G. (2019). Transportation Infrastructures and Socioeconomic Statuses: A Spatial Regression Analysis at the County Level in the Continental United States, 1970–2010. *Spatial Demography*, 7(1), 27–56. <https://doi.org/10.1007/s40980-018-0045-4>
- Khatana, Sameed. (2022, July 20). The Increasing Death Toll in the U.S. From Extreme Heat. TIME. <https://time.com/6198720/heatwave-health-death-toll/>
- Kirmizi, M. (2023). Transport Inequality in Today’s Cities at the Intersection of Mobility and Inequality. *Trafik ve Ulaşım Araştırmaları Dergisi*, 6(1), 17–43.
<https://doi.org/10.38002/tuad.1219025>
- Lin, D., & Cui, J. (2021). Transport and Mobility Needs for an Ageing Society from a Policy Perspective: Review and Implications. *International Journal of Environmental Research and Public Health*, 18(22), Article 22. <https://doi.org/10.3390/ijerph182211802>
- Maclay, K. (2006). *Study explores metro car ownership patterns, race, segregation and disaster planning*.
https://newsarchive.berkeley.edu/news/media/releases/2006/03/23_carownership.shtml
- Malasky, A. (2022). *Analysis of Challenges Facing Pregnant Women Riding Public Transit* (FTA Report No. 0211). <https://doi.org/10.21949/1520697>
- Mikou, M., Rozenberg, J., Koks, E., Fox, C., & Quiros, T. P. (2019). Assessing Rural Accessibility and Rural Roads Investment Needs Using Open Source Data (Beyond the Gap: How Countries Can Afford the Infrastructure They Need While Protecting the Planet). World Bank Group.

- Muhoza, C., Wikman, A., & Chavez, R. D. (2021). *Research trends on gender and transport* (Mainstreaming Gender in Urban Public Transport, pp. 9–10). Stockholm Environment Institute; JSTOR. <http://www.jstor.org/stable/resrep38173.5>
- Newland, Kathleen. (2011) *Climate Change and Migration Dynamics*. Washington, DC: Migration Policy Institute,
- Nielsen, K. S., Nicholas, K. A., Creutzig, F., Dietz, T., & Stern, P. C. (2021). The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. *Nature Energy*, 6(11), Article 11. <https://doi.org/10.1038/s41560-021-00900-y>
- Olson, E. (2020, December 1). *Toxic Masculinity and Climate Change*. *Climate Review*. <https://www.theclimatechangereview.com/post/toxic-masculinity-and-climate-change>
- Peng, Y., Peng, X., Yin, M., He, J., & Ma, L. (2023). The welfare effects of impoverished rural areas: Review and research prospects. *Heliyon*, 9(9), e19513. <https://doi.org/10.1016/j.heliyon.2023.e19513>
- Richarz, A. (2022, June 2). Japan's Transit System Gets Serious About Disability Access. *Bloomberg.Com*. <https://www.bloomberg.com/news/articles/2022-06-02/in-japan-transit-accessibility-gets-an-overdue-boost>
- Ritchie, H., & Roser, M. (2023, September 27). Cars, Planes, Trains: Where Do Co2 Emissions from Transport Come From? *Our World in Data*. <https://ourworldindata.org/co2-emissions-from-transport>
- Romanello, M., Napoli, C. di, Green, C., Kennard, H., Lampard, P., Scamman, D., Walawender, M., Ali, Z., Ameli, N., Ayeb-Karlsson, S., Beggs, P. J., Belesova, K., Berrang Ford, L., Bowen, K., Cai, W., Callaghan, M., Campbell-Lendrum, D., Chambers, J., Cross, T. J., ... Costello, A. (2023). The 2023 report of the Lancet Countdown on health and climate change: The imperative for a health-centred response in a world facing irreversible harms. *The Lancet*, 402(10419), 2346–2394. [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7)
- Romero-Lankao, P., Wilson, A., & Zimny-Schmitt, D. (2022). Inequality and the future of electric mobility in 36 U.S. Cities: An innovative methodology and comparative assessment. *Energy Research & Social Science*, 91, 102760. <https://doi.org/10.1016/j.erss.2022.102760>
- Rosenbloom, Sandra. (2007). *Transportation Patterns and Problems of People with Disabilities*. In M. J. Field & A. M. Jette (Eds.), *The Future of Disability in America*. National Academies Press (US). <https://www.ncbi.nlm.nih.gov/books/NBK11420/>
- Roy, Diana. (2022, June 22). *Crossing the Darién Gap: Migrants Risk Death on the Journey to the U.S.* Council on Foreign Relations. Retrieved January 27, 2024, from <https://www.cfr.org/article/crossing-darien-gap-migrants-risk-death-journey-us>

- Sadan, M., Smyer Yu, D., Lawn, D., Brown, D., & Zhou, R. (2022). Rare Earth Elements, Global Inequalities, and the 'Just Transition.' <https://doi.org/10.5871/just-transitions-s-i/M-S>
- Sanjay, Satviki. (2023, November 6). Free Bus Rides Offer Indian Women New Option for Work, and Play. Bloomberg.Com. <https://www.bloomberg.com/news/articles/2023-11-06/india-inside-shakti-the-free-bus-ride-program-for-women-in-karnataka-delhi>
- Shutkin, W. & Bush, A. (2022, April 4) The Sustainable City Show: Creating Car-Free Communities. Episode 3. <https://thereader.mitpress.mit.edu/the-sustainable-city-creating-car-free-communities/>
- Spielmaker, K. (2023, January 5). What If Transportation Design Centered People, Not Cars? America Walks. <https://americawalks.org/transportation-design-centered-people-not-cars/>
- Sullivan, K., 2021: The Intersection of Socioeconomic Status & Climate Change Risks & Hazards in the United States Great Lakes Region: An Intern Report. An AMS Policy Program Intern Report. The American Meteorological Society, Washington, D.C.
- Szaboova, Lucy & Colón, Christina. (2020). Concepts, Contexts and Categorisations of Climate Mobility (Climate Mobility and Children: A Virtual Symposium). UNICEF. <https://learningforsustainability.net/community-resilience/>
- Treisman, R. (2023, July 12). Heat waves in Europe killed more than 61,600 people last summer, a study estimates. NPR. <https://www.npr.org/2023/07/12/1187068731/heat-waves-europe-deaths-study>
- United Nations Development Programme (UNDP). 2022. Human Development Report 2021-22: Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World. New York.
- United States Environmental Protection Agency, (2022, October 19). *Climate Change Impacts on Transportation* [Overviews and Factsheets]. <https://www.epa.gov/climateimpacts/climate-change-impacts-transportation>
- Wageni, E. (n.d.). *Masculinities, Patriarchy and Climate Change*. HeForShe. Retrieved January 2, 2024, from <https://www.heforshe.org/en/masculinities-patriarchy-and-climate-change>
- Walsh, M. (2007). Gender in the History of Transportation Services: A Historiographical Perspective. *The Business History Review*, 81(3), 545–562. JSTOR.
- Walsh, M. (2008). Gendering Mobility: Women, Work and Automobility in the United States. *History*, 93(3 (311)), 376–395. JSTOR.
- World Health Organization. (2023, November 21). *Climate change is an urgent threat to pregnant women and children*. <https://www.who.int/news/item/21-11-2023-climate-change-is-an-urgent-threat-to-pregnant-women-and-children>

- Wormington, Jim. (2022, August 10). If Electric Cars are the Future, Let's Make them Responsibly [Human Rights Watch]. <https://www.hrw.org/news/2022/08/10/if-electric-cars-are-future-lets-make-them-responsibly>
- Xia, W., Apergis, N., Bashir, M. F., Ghosh, S., Doğan, B., & Shahzad, U. (2022). Investigating the role of globalization, and energy consumption for environmental externalities: empirical evidence from developed and developing economies. *Renewable Energy*, 183, 219-228.
- Yeampierre, Elizabeth. (2020, June 9). Unequal Impact: The Deep Links Between Racism and Climate Change (Gardiner, Beth, Interviewer) [Interview]. <https://e360.yale.edu/features/unequal-impact-the-deep-links-between-inequality-and-climate-change>
- Zukowski, Dan. (2022, March 11). 7 ways cities can make transportation safer for women: Study. Smart Cities Dive. <https://www.smartcitiesdive.com/news/7-ways-cities-can-make-transportation-safer-for-women-study/620235/>