Chapter 5:

Securing a Greener Urban Future

Quick facts

1. Current net zero policies have pitfalls, including an overreliance on underdeveloped technologies that overlook local resources and the lack of integration of local governance strategies in national programmes for action.

2. Climate impacts and other environmental crises interact with drivers of urban inequality, which threatens the futures of cities.

3. Greener futures cannot be secured without just transitions.

4. The world is losing the opportunity to use the post-pandemic context as a catalytic moment to facilitate investment for a transition to net zero carbon emissions.

Policy points

1. Achieving net zero is also dependent on subnational and city-level action. Policymakers at all levels must therefore recognize and support the role of urban areas in the net zero transition.

2. Nature-based solutions must be part of inclusive planning processes for sustainable urban futures—local action to secure greener futures cannot overlook their vital role.

3. In environmental decision-making, diverse voices and perspectives must be heard to minimize uncertainties in the pathways to securing greener urban futures.

4. Various levels of government and institutions should harness the potential of international partnerships such as transnational networks and social movements in delivering greener urban futures.

We are living a unique moment, where the world is transcending a pandemic whose recovery efforts are entangled with a push to develop alternative futures. The climate crisis—and related goals of keeping the global average temperature change under 1.5 degrees—and avoiding mass extinction now a primary concern at various levels of governance. Cities continue to be at the forefront of environmental and sustainability action, although after a decade of optimism, their role in constructing sustainable urban futures is increasingly questioned by the public, especially younger generations operating with a sense of urgency out of fear for their future. In short, the promise of sustainable urbanization remains unfulfilled.

Calls for urgent action on the climate and biodiversity crises emphasize the need to build sustainable urban futures. The challenge for various actors is to envision how those futures can make urban space liveable for humans while not contributing to environmental degradation. But multiple uncertainties shape environmental action. While living in the Anthropocene, we must recognize the impact humans have on the Earth as a whole, with implications for human societies and ecosystems.[1] Previous editions of the UN-Habitat World Cities Report have argued that there are opportunities to harness the value of sustainable urbanization to advance green, resilient and more equitable futures.

The goal of limiting average mean temperature rise to 1.5°C by 2100 has become a policymakers' guiding metric to imagine sustainable futures

The goal of limiting average mean temperature rise to 1.5°C by 2100 has become a policymakers' guiding metric to imagine sustainable futures. In 2018, the IPCC Special Report identified two pathways to maintain this goal. The first pathway is to stabilize global warming at or below 1.5°C above pre-industrial levels. The second pathway, also called an "overshoot" pathway, foresees global warming exceeding 1.5°C around mid-century, remaining above 1.5°C for a maximum duration of a few decades, and returning to below 1.5°C before 2100.[2] Both pathways highlight mitigation and adaptation efforts in multiple sectors, including energy, transportation, forestry and sustainable land use.

Despite securing net zero commitments from 153 countries, the Glasgow Climate Pact negotiated at COP26 in November 2021 showed that current steps to limit global warming are insufficient. The lack of ambition in current national commitments echoes a lack of imagination in defining alternative urban futures. Much of the debate has rightly focused on keeping the 1.5°C goal alive, with subnational governments making new commitments that accelerate climate targets to 2030.[3] At the same time, the great extinction likely to sweep away the world's biodiversity speaks to the disconnection of human activity from its natural surroundings.[4] There is one last chance for humanity to reconcile with the possibilities of living on Earth, shift development pathways, and reconnect with the stewardship role that recognizes a mutual and beneficial relationship between humans and the environment. Every citizen has a role to play in actively engaging with the urban landscape.

This chapter analyses the interrelated challenges of climate change and biodiversity to explore how alternative urban futures could be developed. The rationale of the chapter follows an examination of the ideas about the future that dominate planning practice. In particular, the chapter engages with two alternative future-oriented approaches. On the one hand, the chapter examines the growth of scenario planning and scenario modelling to consider what the future means for urban areas. On the other hand, following the operation of scenarios in practice, the chapter recognizes the need to include multiple perspectives and acknowledge inequality in planning practices. These two cross-cutting themes are examined in six sections that explore different aspects of delivering green urban environments: the transition towards net zero carbon, the future of urban transport, the increasing importance of building resilience, the growing visibility of nature-based solutions, the development of inclusive urban planning, and the constitution of global partnerships to deliver green urban futures. Each section thus explores the treatment of futures, how future visions influence planning practice as well as their impact on populations across the urban-rural continuum.

5.1. Urban Transitions to Net Zero GHG Emissions

Net zero GHG emissions means achieving balance, over a specified period, between anthropogenic GHG emissions produced by human activities and those removed from the atmosphere through reduction measures.[5] The transition to net zero emissions requires sustainable consumption and production practices that facilitate responsible resource use and address climate change's adverse impacts. However, the conceptualization of net zero carbon varies across scales and

sectors. For example, territorial approaches, which calculate emissions within national borders, are widely used at the national scale for carbon accounting.

By contrast, the conceptualization of net zero emissions at the city level faces two practical challenges. First, inventory data at the city level is often unavailable. Second, cities present specific complexities due to their "smaller spatial scale and embeddedness within larger-scale social, ecological and infrastructural systems."[6] For instance, urban energy and economic systems depend on long-distance exchanges. Accounting for these transboundary carbon flows is challenging when considering the city as an analytical unit for carbon measurements.[7] A net zero carbon city can be imagined quite differently depending on the focus of carbon accounting approaches—whether net zero territorial emissions, net zero community-wide physical provisioning systems, net zero household expenditures, or net zero trade.[8]

Recent research warns against undue optimism with regards to net zero scenarios.[9] Current climate simulation models may effectively simplify (and thus downplay) social and political realities affecting the actual impacts of climate change.[10] The concept of net zero may also distract attention from the urgency of emission reductions by shifting faith onto unrealistic carbon removal measures.[11] Such technologies are still developing and not yet available for large-scale applications.[12] The promise of carbon removal technologies bolsters market environmentalism narratives that strengthen capitalism and reinforce existing social and spatial inequalities.[13] The stabilization of emissions is a necessary but insufficient condition to manage climate change, and reaching zero emissions will not cancel climate impacts.[14]

5.1.1. The role of scenarios in defining net zero urban futures

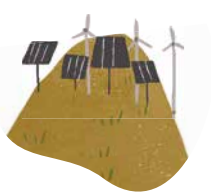
Net zero urban futures depend on the development of net zero scenarios at the national level and how such influence urban thinking. Scenario modelling assists decision-making in climate policy.[15] The latest generation of climate models informs the urgency to reach net zero emissions.[16] These models also outline physical and policy pathways to net zero emissions, including measures to reduce the use of carbon-intense materials (such as substituting materials, facilitating recycling, introducing carbon pricing and removing energy subsidies), support research and development of decarbonized technologies, and sunset policies for obsolete high-carbon facilities.[17]

Solar panels in a car park. Companies are installing renewable energy sources to reduce their carbon footprint. Reggio Calabria, Italy

Net zero decarbonization requires country-specific strategies that take into account each nation's development priorities.[18] In the UK, for example, a study suggests that achieving net zero emissions before 2050 will require more vigorous mitigation efforts than those currently envisaged by national policy.[19] Lines of action should include commercial-scale deployment of carbon capture and sequestration technologies, a quicker phase-out of fossil-based generation, higher deployment of wind and nuclear power, and more radical reductions in emissions from the transport and building sectors. In Latin America and the Caribbean, well-proven strategies can support net zero pathways, including urban electrification for households and transport, transport mode shifting, and the combination of intensive sustainable agriculture with afforestation.[20]

Achieving net zero ultimately depends on subnational and city-level action. Several net zero planning models are currently under development. Building-level carbon budgets, for instance, provide consistency across temporal and spatial dimensions of carbon reductions.[21] Planning for net zero cities depends on having appropriate climate information as part of the evidence base, but this information is not always available. Climate projections can inform decisions in urban planning, which points towards the increasing role that planning can play in shaping urban futures.[22] Innovative models that could support multi-objective decision-making in urban planning and governance, such as scenario-based planning,[23] multiperiod planning,[24] and multi-objective decision-making[25] are in the early stages of development but offer significant promise.

Scenarios can inform protective decisions to mitigate risks. For example, recent modelling shows that over the next 50 years. climate change will likely increase cross-species viral transmission risk, as mammals are driven to cooler regions.[26] Scenarios can also inform proactive decisions to seize opportunities. They can also contribute to consensus building among many actors, broadening support for a complex net zero transition.[27] However, despite the popularity of climate simulation models, policy decisions should not rely solely on the outcomes of quantitative scenario modelling.[28]



Net zero decarbonization requires country-specific strategies that take into account each nation's development priorities

Their results depend on subjective framing of objectives, contexts and methodologies.[29] Building net zero scenarios is particularly challenging because it involves long time frames and detailed speculation on technological and social changes, with inferences across different sectors and processes.[30] Scenario building approaches appear technocratic, limiting actors' agency and mobilizing simplified assumptions about social and political dynamics.[31]

The combination of quantitative models with qualitative storylines is an alternative to move beyond simplified narratives that rely solely on computer modelling.[32] For example, socio-technical transition theories highlight the co-evolution between social change and technological development. Yet, while such analyses expose the historical trends of socio-technical dynamics, they often cannot predict how such dynamics might develop in the future.[33]

Socio-technical scenarios help to bridge computer models, and socio-technical systems theories.[34] Socio-technical scenarios support speculation on future transition pathways, considering actors' agency and the interactions between multiple dimensions (both techno-economic and socio-political) of a socio-technical system.[35] Contributions from the humanities and the creative sector will enhance the creation and deliberation of climate change scenarios towards imaginative futures.[36] This perspective highlights the importance of cultural work on climate change that acknowledges scenarios' historical and cultural roots.[37] However, there have been limited applications of multi-method modelling in urban planning and urban governance so far.

5.1.2. Policies for a net zero urban future

National and subnational governments, international coalitions and private entities have made increasing net zero emissions pledges in the last few years. In May 2021, the International Energy Agency (IEA) released a special report on the pathways toward a global net zero energy system by 2050. The report sets out more than 400 milestones that need to be achieved to reach the net zero goal in the energy sector by 2050. These include major transformations such as increasing the annual clean energy investment worldwide to around US$4 trillion by 2030, halting sales of new internal combustion engine passenger cars by 2035, and phasing out all unabated coal and oil power plants by 2040.[38]

According to IEA, more than 50 countries have set net zero emissions targets,[39] of which 12 countries have written the net zero target into law, including Germany (2045), Sweden

(2045), Canada (2050), Denmark (2050), France (2050), Hungary (2050), Japan (2050), Luxembourg (2050), New Zealand (2050), South Korea (2050), Spain (2050) and the UK (2050). However, some of the strategies have faced criticism of being unrealistic—essentially, being "pie-in-the-sky"—and failing to include policies that would deliver promised cuts in emissions. The UK government, for instance, has been sued separately by two charities—ClientEarth and Friends of the Earth— in this regard.[40] Net zero policies have attracted interest but also courted controversy (Box 5.1).

Box 5.1: Let's make a "Green" Deal: Infrastructure, jobs and the green economy

Several countries—including China, European countries, and the US— have developed policy frameworks, sometimes referred to as "Green Deals," to address the twin challenges of climate change and pandemic recovery, emphasizing job creation and infrastructure investment.[41]

A new infrastructure bill adopted in November 2021 by the US will invest US$1 trillion in ports and transportation systems, high-speed internet, clean water, roads and bridges, mass transit, and clean energy infrastructure, creating millions of jobs. The European Commission also adopted a European Green Deal (EGD) in 2019, later coordinated with the COVID-19 recovery plans in NextGenerationEU, with a strong emphasis on digital technologies.[42]

However, there are questions about the extent to which infrastructure investments are the best approach to deliver a transition, particularly what kind of actions these frameworks will foster at the local level. In the US, ten state and local governments have adopted subnational versions of the Green New Deal, including Austin, Texas; Los Angeles, California; New York City; and Boston, Massachusetts.

In the European Green Deal, cities play a central role in specific strategies such as the Circular Economy Action Plan, the Biodiversity Strategy for 2030, the Farm to Fork Strategy and the Renovation Wave.[43] In 2020, the European Commission announced an EU mission on Climate-Neutral and Smart Cities to deliver 100 climate-neutral and smart cities by 2030 that can act as experimentation and innovation hubs.[44]

Delivering the net zero transition depends on cities, and many cities are willing to work towards net zero. At least 1000 cities worldwide have committed to net zero objectives under the UNFCCC-led Race to Zero campaign.[45] Cities can deliver critical actions to advance social changes, such as modal shifts, infrastructure upgrades, energy efficiency and low-carbon urban forms.[46] However, cities accommodate a fragmented landscape of infrastructure and technology ownership that often cuts across urban boundaries. A net zero transition at the urban level requires both autonomy and coordination.[47] Thus, urban transitions to net zero need to be supported by horizontal integration (multi-actor) and vertical coordination (multilevel).[48]

Policies at higher level governance scales (e.g. regional, national and international) can serve as a guiding framework for city-level actions.[49] An analysis of the climate action plans of 296 cities with net zero targets showed that cities' approaches to net zero evolve within broader governance contexts.[50] Cities in lower-income countries are more likely to rely on local and community actions and focus on climate adaptation and risk management that echoes national-level climate strategies. In contrast, cities in higher-income countries tend to highlight climate actions in transport, buildings and lighting by focusing on efficiency and leadership.[51] Support from national governments is essential (Figure 5.1).[52]

Figure 5.1: National-level pillars for supporting local climate action

Clarifying governance competences	Financial and institutional support	Coordination of multiple actors	Experimental, participatory culture

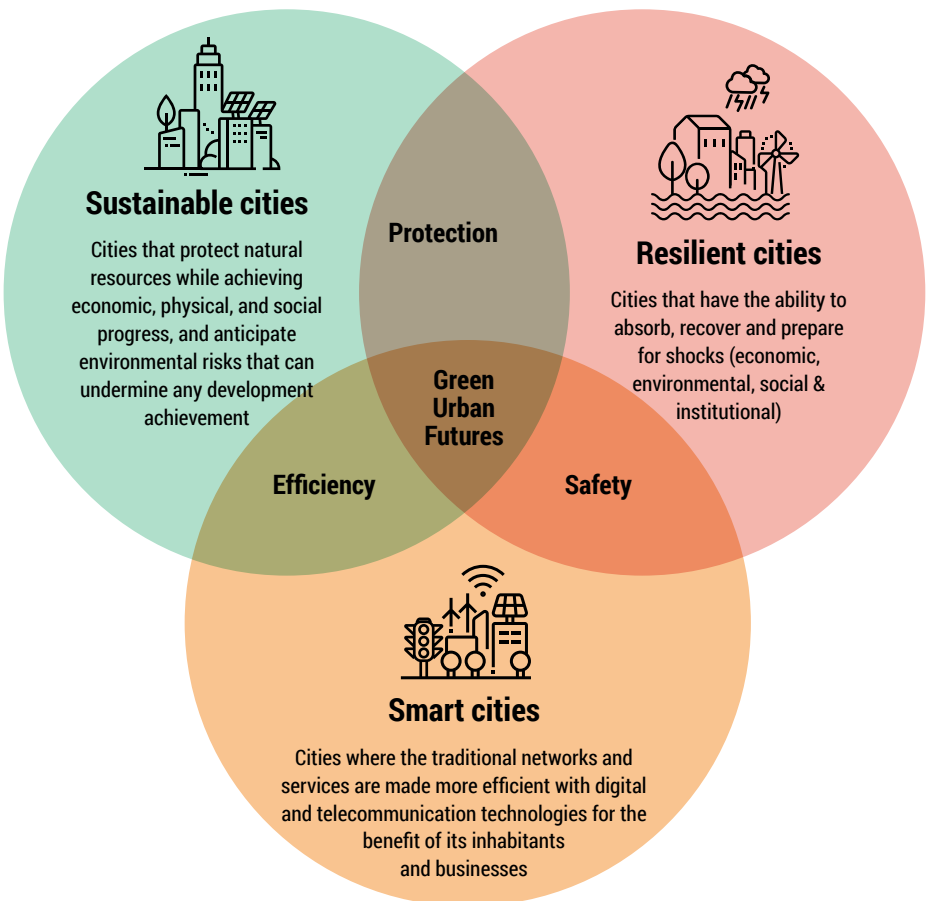
Source: Coalition for Urban Transitions, 2019.

The Sustainable Development Goals are another arena of national commitment that requires local implementation. Cities can coordinate net zero action with localized action to deliver the SDGs. For countries in Africa and South Asia facing dire energy access challenges, delivering a net zero transition must go hand in hand with alternatives that provide energy access to populations with some of the lowest carbon footprints in the world. In 2019, despite progress in advancing SDG7 on energy, an estimated 759 million people still lacked access to electricity and 2.6 billion people lacked access to clean cooking facilities.[53] The IEA forecasts that, as population growth continues in Africa, energy access challenges will continue unabated. While electricity access rates are higher in urban areas, urban dwellers still face energy access challenges related to affordability and reliance, particularly in rapidly growing urban peripheries. Local governments and other urban actors have an essential role in linking the urban net zero transition with other sustainable development objectives such as energy access. Carbon mitigation policies for off-grid energy or energy efficiency directly alleviate some of the energy access challenges.

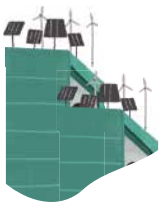
Moreover, urban areas can help accelerate the net zero transition. For example, the EU's 2050 net zero strategy considers cities as experimentation centres in sectors such as energy, transport, and construction.[54] Different models of low-carbon, sustainable cities developed over the years have been implemented in practice, with rich lessons for net zero cities.[55]

However, existing models of urban development that favour net zero action (as illustrated in Figure 5.2) cater to well-established cities with access to financial resources and advanced technologies such as Singapore, Stockholm or Vancouver, among others. There is less understanding of what net zero will mean for rapidly urbanizing areas

Figure 5.2: Models of net zero development in urban areas



Source: Compiled from Arcadis, 2018; Hassan and Lee, 2015; Barkham, 2013; OECD, n.d.; IMD, 2021; European Commission, 2022.



Net zero action must balance localized interventions in buildings and neighbourhoods with citywide approaches seeking to deliver concerted action

and the growing urban peripheries in Latin America and the Caribbean, Africa, the Middle East, South Asia and Southeast Asia. Yet, rapidly urbanizing areas are accumulating experiences that will become increasingly relevant in the net zero transition.

Net zero action must balance localized interventions in buildings and neighbourhoods with citywide approaches seeking to deliver concerted action. There are several examples of successful localized interventions. The building sector, in particular, is a crucial arena for advancing net zero in cities (Table 5.1). In the European Union, the EU Energy Performance of Buildings Directive (EPBD) requires that all new buildings constructed since the beginning of 2021 must be nearly zero-energy buildings. Achieving such a goal depends on designs with significant energy-saving features, such as efficient heating, ventilation, and air-conditioning (HVAC), and lighting technologies.[56]

At the same time, the retrofitting of the existing building stock constitutes a significant challenge to reducing the GHG emissions of the building sector.[57] Retrofitting the current building stock is often considered a cost-efficient way of reducing building energy consumption.[58] The move from single buildings to the district scale—for example, in Net Zero Energy Districts (NZED)—has shown potential for large-scale emission reductions.[59] NZEDs require innovative solutions for street lighting, urban mobility, waste collection, and public safety.[60] A scenario study in Belgium, for example, identified the importance of building renovation, sustainable mobility, and the integration of local renewable energy

Table 5.1: Reducing emissions in the built environment, examples of actions

Area of action	Rationale	Evidence of progress
Adoption of building codes at the national level	Building codes are generally used in the context of safety but are also helpful in reducing emissions by regulating energy-related components such as thermal performance and wall thickness. They also have dividends for residents, making houses more comfortable and reducing energy bills.	The Global Alliance for Buildings and Construction says that 18 new countries have adopted building codes since 2017 and building codes are frequently cited in Nationally Determined Contributions. The alliance also reports that green building certification increased 13.9 per cent between 2019 and 2020.
Energy efficiency measures	Energy efficiency includes measures to reduce the amount of energy that provides a similar level of service, for example, by changing the technology and materials used or optimizing the system through digital systems. Changing an incandescent lamp to a more efficient LED lamp is one of the simplest examples of energy efficiency measures. The IEA estimates that energy efficiency could provide more than 40 per cent of the emissions reductions needed by 2040.	The Global Alliance for Buildings and Construction estimates that global investment in the energy efficiency of buildings increased an unprecedented 11 per cent in 2020. Still, investments remain concentrated in the EU, and it is thought to be insufficient to bring about a systemic change.
Integrated approaches to cooling	The use of energy for cooling, especially air conditioning systems, has skyrocketed. As global average temperatures increase, the use of energy for cooling is likely to increase. Ways to prevent excessive cooling include developing integrated cooling systems and changing perceptions of thermal comfort.	The Cool Coalition recommends reducing need for mechanical cooling through better building design and urban planning, improving equipment efficiency, shift to renewables and protecting vulnerable populations. While progress in these areas is slow, notable highlights include: 14 cooling suppliers joined the Race to Zero campaign, representing 28 per cent of the residential AC market; 53 enhanced Nationally Determined Contributions have integrated sustainable cooling.
Urban electrification	The WGIII report of the IPCC states: "electrification of energy end uses in cities and efficient energy demand for heating, transport and cooking through multiple options and urban infrastructure has an estimated mitigation potential of at least 6.9 GtCO2-eq by 2030 and 15.3 GtCO2-eq by 2050", but also requires the decarbonization of the energy supply.	The use of heat pumps, photovoltaic energy or electric cookstoves improves energy efficiency and may enable the active decarbonization of the energy supply. Urban electrification may also help reconfigure supply networks more sustainably through smart grids. However, while evidence of the successful electrification of urban transport is apparent, widespread urban electrification in buildings is less clear.

Sources: UNEP, 2021a; UNEP, 2021b; IEA, 2021a; IPCC, 2022a.

Ecological modern building . Warsaw University in Poland.

sources to achieve net zero at the neighbourhood level.[61] There is considerable potential for district-based approaches to net zero. Still, they face two challenges: to move beyond experimental stages in well-resourced cities into broad models that can provide workable alternatives elsewhere and to interrogate how district-based action can be integrated into citywide plans that reflect the changing needs of both city centres and urban peripheries.

The COVID-19 pandemic showed the potential feasibility of net zero ambitions, but public health measures in response to the virus had short-lived effects on reducing carbon emissions. It also demonstrated that efforts to reduce carbon emissions should go hand in hand with ameliorating people's vulnerabilities (see section 5.3). Lockdowns and disruptions in the global supply chain led countries like China to consider measures that effectively decarbonized the economy.[62] In urban areas, COVID-19 'forced' residents to interact with their cities in a more sustainable way, as people shifted to walking and cycling[63] and rediscovered the value of green spaces.[64] However, as emissions have picked up, economic recovery has been prioritized at the expense of net zero investments. A comparison of the economic recovery packages of 149 countries found that investments in net zero transitions are minimal compared with pandemic-related stimulus funds while fossil fuel production support remains strong (Box 5.2).[65]

5.1.3. Social change is central to a net zero urban transition

Lasting reductions in greenhouse emissions require social change.[66] Demand-side solutions for mitigating climate change include strategies targeting technology choices, consumption, behaviour, lifestyles, production-consumption infrastructures and service provision.[67] Demand-side mitigation strategies are critical to meet emission reduction targets and often entail fewer environmental risks than many supply-side measures.[68] Since they depend on interactions between technological

efforts to reduce carbon emissions should go hand in hand with ameliorating people's vulnerabilities

and social change,[69] net zero transitions are value-laden and depend on societal preferences.[70] Social change manifests in individual-level social behaviours, practices (e.g. everyday eating or mobility), and broader social relations and structures.[71] The IEA, for example, has proposed changes in urban areas, such as phasing out internal combustion engine cars and promoting ridesharing for all urban car trips.[72]

However, the contributions of behavioural change to net zero are limited. Behavioural change in urban areas (e.g. replacing car trips with walking, cycling or public transport, or foregoing long-haul flights) could provide around 4 per cent of cumulative global emissions reductions.[73] Alternatively, urban communities can play an active role in transition processes e.g. through spawning urban innovation, participating in political coalitions for change or redefining how they engage with infrastructure and markets.[74] Such a transition would require moving away from conceptualizing urban dwellers as consumers who influence the transition via consumer choices and instead recognize people as active makers of their urban environments.

Net zero transitions also involve a broader change in the cultural, legal and institutional frameworks that guide the production and use of technology, the everyday practices of organizations and consumers, and design choices for products and infrastructures.[75] In addition, social movements may foster innovation and transitions towards net zero.[76]

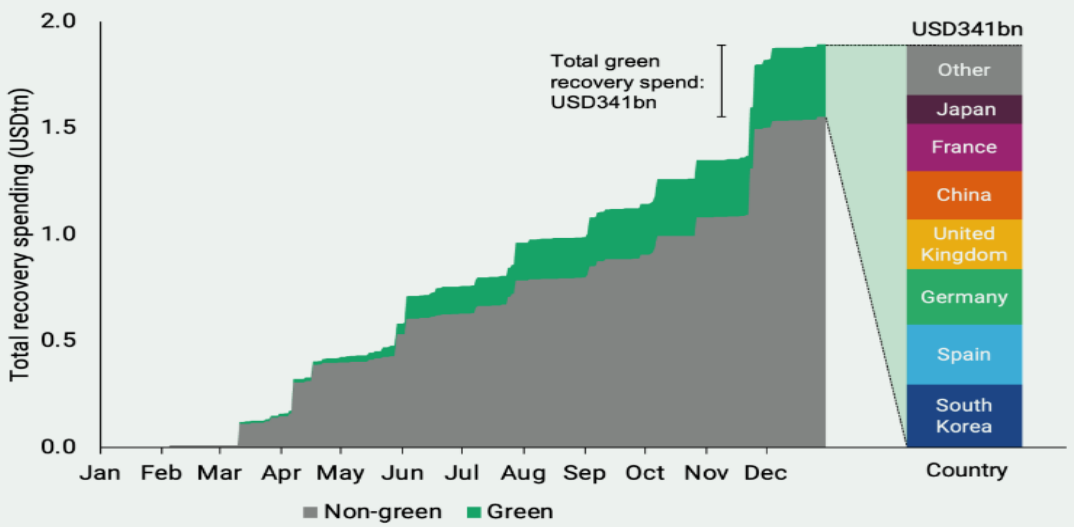
Market-based incentives and voluntary agreements are insufficient to bring about this kind of social change in urban areas.[77] Instead, local governments should implement

Box 5.2: Green recovery: Commitments and actions misaligned?

Evidence suggests that amidst the call for greener urban futures, global green spending is so far incommensurate with the scale of ongoing environmental crises. A recent study by UNEP of the 50 largest national economies found that only US$368 billion of US$14.6 trillion COVID-induced spending—or just 2.5 per cent of total spending (both rescue and recovery)—in 2020 was green while only 18 per cent of recovery spending was considered so.

Moreover, reports also show that 15 major producer countries continue to provide significant policy support for fossil fuel production; their production plans and projections would lead to about 240 per cent more coal, 57 per cent more oil, and 71 per cent more gas in 2030 than would be consistent with limiting global warming to 1.5°C.

Recovery spending over the course of the pandemic with total green spending, 2020



Source : UNEP, 2021c; SEI et al, 2021.

effective public policy measures such as carbon taxes, building codes, congestion zone charging and subsidies for renewable consumption.[78] However, these measures alone are not sufficient to cause wider social change and they may have negative consequences for vulnerable populations. Ultimately, inclusive planning has a crucial role in fostering a societal transition to net zero (see section 5.5).

5.2. The Future of Urban Transportation

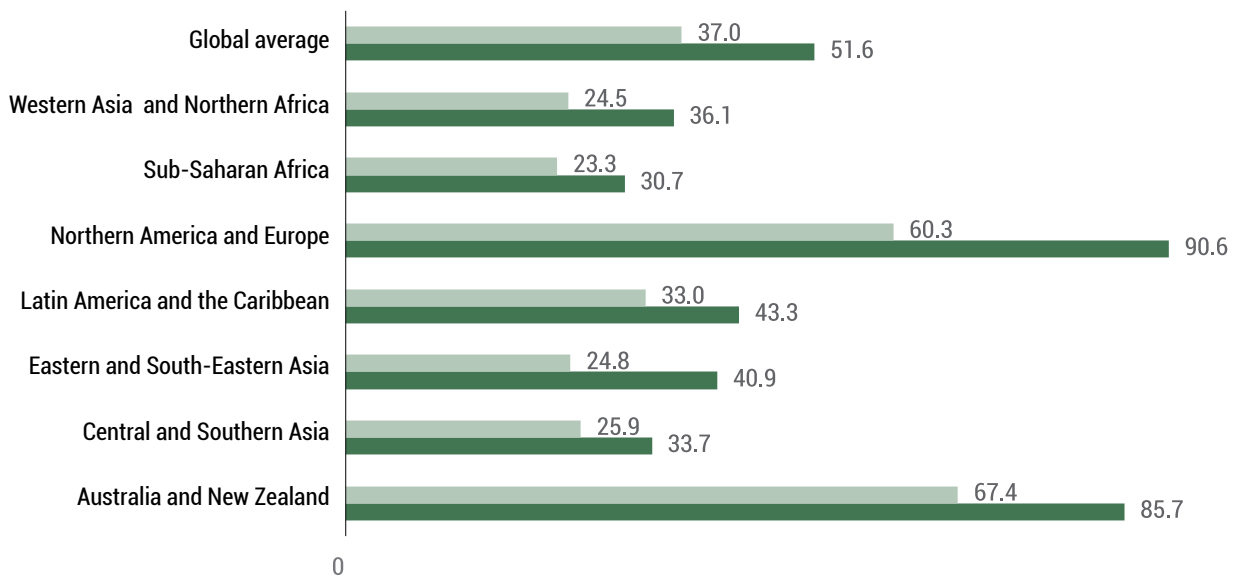
Greenhouse gas emissions from transport are increasing faster than any other energy-using sector. The transport sector accounted for 27 per cent of global emissions in 2019.[79] While the restrictions and lockdowns associated with COVID-19 pandemic resulted in a fall in CO_2 emissions from the global transport sector, rebounding demand and anticipated growth are resulting in a steady rise of emission to pre-pandemic levels. Of special concern are road transport emissions, as three-quarters of current global greenhouse gas emissions from the transport sector are generated by road transport alone.[80]

Securing greener urban futures will require planning for sustainable transport and mobility within and beyond cities to reduce energy consumption, air pollution, noise and GHG emissions. Sustainable mobility can also improve people's health and well-being, for instance, through active travel modes like cycling and walking and by reducing commuting time. Sustainable urban mobility depends on the provision of low-carbon transport infrastructure, the introduction of energy-saving technologies and the design of adequate transport planning frameworks.

The pursuit of greener urban futures calls for transport policies that encourage a shift from private cars to public transport, shared vehicles or active travel. Yet, data for 2020 from 1,507 cities from 126 countries shows that, on average, only about one-half of the urban population has convenient access to public transport (Figure 5.3). Often, most people in cities are unable to access sustainable transport options, public or private, due to lack of appropriate infrastructures or individual conditions (e.g. living with disabilities, old age or gender-based restrictions), among other reasons.

Moreover, it is often the poorest communities who depend on cycling and walking. In cities like Addis Ababa, Nairobi, Dar es Salaam or Lagos, more than 40 per cent of the population depend on cycling and walking for their mobility.[81] Thus, sustainable transport futures require looking beyond regulated transport infrastructure provision and planning for diverse mobility needs.[82] Holistic approaches will require more than just "magic bullet" technologies like electric vehicles. The expansion of transportation networks will require strategies that mix public transport options and car-sharing, as well as incentives to encourage non-motorized

Figure 5.3: Public transport: coverage and share of population with convenient access, 2020



Source: Data Analytics Unit, UN-Habitat.

travel and reduce the need to travel over long distances (Table 5.2). Addressing cities' reliance on private transport requires the consideration of complex mobility needs of urban communities. Challenges in the shift to clean transportation include affordability, convenience, ease of travel, availability of different options, the distance between housing and workplaces and personal safety issues.

5.2.1. Public health and the challenges of congestion and air pollution in cities

Traffic congestion and air pollution represent key health challenges for cities worldwide, as urban areas expand to accommodate a growing population. Unplanned urban expansion, the public's reliance on motorized road transport and high volumes of freight transport to meet urban consumption contribute to maintaining high levels of air pollution.[83] According to the World Health Organisation (WHO), air pollution—ambient and household air pollution—is linked to 7 million premature deaths, annually.[84] WHO estimates also show that 99 per cent of the world population breathes air containing a high level of pollutants (exceeding WHO guideline limits), with in low- and middle-income countries more affected.[85]

Urban air pollution can result in adverse health outcomes, such as heart attacks, strokes, cancer and chronic obstructive pulmonary disease. There is growing evidence that air pollution affects children's neurological development. In a 2018 report, WHO estimated that 93 per cent of the world's children are exposed to toxic air daily, putting their health at risk.[86] Acute lower respiratory infections caused by polluted air has been linked to the death of 600,000 children in 2016. Vehicular traffic congestion poses other public health risks, including exposure to excessive noise, elevated ambient air temperatures and reduced physical activity.[87] Researchers estimate that around 2.1 million deaths can be attributed to insufficient physical activity every year,[88] while accidents involving motorized vehicles are responsible for approximately 1.35 million deaths annually.[89]

Reducing traffic congestion can positively impact emissions reductions objectives and urban dwellers' health. Measures to reduce traffic congestion include reallocation of road space to non-motorized transport, congestion charging to reduce the presence of polluting vehicles in cities, incentives for walking and cycling, public transport provision improvements and car-free days (Box 5.3). Integrating health impact scenarios into

Table 5.2: Approaches to sustainable urban mobility

	Approach	Goal	Examples
Rapid Transit Systems 	Rapid transit systems operate on a fixed route that increases the service's speed, capacity and reliability. They include rail transit systems (overground and underground) as well as bus systems operating on segregated lanes (not accessible to cars)	Ease traffic congestion	Investments in low-carbon bus rapid transit systems, light rail and underground systems
Vehicle and Fuel Switching 	Vehicle switching refers to incentives (subsidies or taxation) that encourage switching to low-carbon private cars and public transportation systems.	Reduce GHG emissions and air pollution	Subsidies for electric cars; introduction of low-emission zones (extra charge for diesel vehicles driving in certain areas), developing charging stations for electric vehicles, public investments into electric/hydrogen-fuelled public transport systems (e.g. buses), etc.
Active Travel Promotion 	Active travel promotion refers to initiatives that encourage walking and cycling for daily trips and discourage private cars.	Reduce GHG emissions and air pollution, enhance public health, disincentivize private car use for short trips.	Reallocation of road space for walking and cycling; regular road closure to create "play streets"; car-free days.
Shared/ collective transport 	Collective transport represents an alternative to private car ownership and public transportation for trips not well covered by existing public transportation networks.	Address gaps in public transportation networks; disincentivize private car ownership.	Digitally enabled carpooling and car-sharing, but also regulated and informal collective taxis or mini-buses.

Box 5.3 Car-free and carefree: The movement to open streets for people

While no major city has banned cars permanently, a combination of policy responses to energy price shocks, advocacy for human-scale urbanism and strong mayoral leadership have strategically limited when and where cars can occupy streets and other urban public spaces. In 1973, the governments of Denmark, the Netherlands, Switzerland and West Germany enacted a series of "car-free Sundays" to conserve scarce gasoline during the OPEC oil embargo. The next year, Bogotá (Colombia) residents petitioned their government for bicycle-only paths on Sundays. That effort planted the seeds for what in the 1990s became an expanded car-free Sunday known as Ciclovía (Spanish for "cycle way"), which closes approximately 120 km of streets to cars and opens them up to people for cycling, walking, rolling, vending, exercise and other non-motorized uses.

The car-free Sunday concept spread beyond Bogotá and has proven exceptionally popular in cities across the developing world where urban residents traditionally have less access to leisure and recreation opportunities. Jakarta (Indonesia) adopted car-free Sundays in 2012, while several Indian cities have tried with mixed results. In Africa, Kigali (Rwanda) introduced car-free Sundays as a monthly event in 2016 which, due to its popularity, became fortnight occurrence. The Ugandan cities of Kampala and Jinja take an explicit stance with the theme "I am the solution to pollution and traffic in my city," while the car-free days are annually observed in Addis Ababa and other major cities in Ethiopia.

This enthusiasm in the developing world is matched by increasing efforts in developed world cities to remove cars from certain parts of cities. In recent years, Paris has banned cars from a roadway along the Seine River, Oslo and Amsterdam have removed parking spaces from the city centre, and Barcelona has pioneered the "superblock" urban design model that prioritizes people over cars on certain blocks. The need for social distancing during the COVID-19 pandemic provided additional motivation to allocate public space for people rather than cars. Milan announced the reallocation of 35 km of streets and road space to walking and cycling, while Paris announced the conversion of 50 km of roads into cycling infrastructure.

Meanwhile, in a flashback to the 1970s, the IEA has proposed car-free Sundays as a measure to reduce oil consumption during the oil price shock of 2022. This recommendation illustrates how much the car-free city concept resonates in public discourse about energy savings and improving urban environments. However, scientific analysis of car-free days is scant, with little empirical evidence on how much such events reduce environmental degradation, even if they capture the public's imagination.

Source: Whitney, 1973; Guillermoprieto, 2019; UNEP, 2020a; Peters, 2020; IEA, 2022; Glazener et al, 2022; COVID Mobility Works, n.d.

sustainable transport planning is essential to secure greener, healthier and safer futures for everyone.

Urban dwellers are unevenly affected by the negative impacts of congestion and air pollution, as low-income groups, children, women and girls, and the elderly are often more vulnerable. Environmental justice research shows that schools in low-income neighbourhoods are more likely to be located near polluting infrastructure.[90] Low-income groups also face limited transport and mobility options and endure longer and more expensive commutes relative to their income.[91] Women and sexual minorities are more likely to face harassment in public spaces and public transport, during the day and night. The mobility of people living with disabilities, the elderly, and children is also significantly hindered in many cities.

Therefore, equity and safety issues must inform interventions that encourage active travel and public transport. In addition, modelling tools and future scenario assessments that account for differentiated mobility needs and uneven access to different transport modes are required to make cities safer, more sustainable and liveable for everyone.

5.2.2. Rethinking futures in transport planning

Transport planning requires navigating uncertain futures shaped by climate change, economic instability, travel demand, changes in individuals' behaviours and preferences, technological disruption and global pandemics. Designing sustainable transport systems in cities requires a mix of qualitative and quantitative tools involving a wide range of stakeholders in order to define collective futures. Decision-makers can design policy with the help of tools that can

anticipate future travel demand and measure the impact of particular interventions. Quantitative tools include model sensitivity analysis, stochastic modelling, Monte Carlo simulations and Bayesian Networks. Qualitative tools include Delphi methods, road mapping, backcasting and scenario planning.

A high degree of flexibility and adaptability is required to navigate deep uncertainty.[92] Quantitative transport planning tools such as forecasting (anticipating future travel demand based on past trends) do not cope well with the uncertainty brought about by unexpected events like the COVID-19 pandemic, long-term trends with a wide range of potential impacts like global climate change and rapid urbanization, and accelerated technological innovation in the transport sector. A review of 210 infrastructure projects across 14 countries concluded that forecasters often overestimate future transport demand.[93]

Scenario planning is a means to shift current sustainable mobility and transport planning practices from regime-compliant (adhering to past trends in the transport sector and transport policy) to regime-testing (making transgressive policy decisions for sustainable futures).[94] Scenario planning integrates both quantitative and qualitative planning tools to design transport interventions and stakeholders' views.[95] Traditional forecasting methods are used alongside more qualitative assessments of plausible and desirable futures. A complementary technique is backcasting, which identifies desirable objectives (e.g. achieving zero-carbon emissions through mobility planning or enhancing access to reliable and affordable transport) and works backward to build a series of steps and interventions to achieve those over a specific timeframe.[96]

Achieving sustainable transport systems in complex urban environments requires integrating transport planning with other policy domains. For instance, health impact assessments (HIAs) are integrative modelling tools to mainstream public health concerns into policy. However, urban dwellers are rarely involved in the development of HIAs for urban and transport planning.[97] Involving people in decisions relating to public health improves the efficacy of any interventions and, in the case of sustainable mobility, can help include people as active agents in a collective modal shift towards active travel.

Achieving sustainable transport systems in complex urban environments requires integrating transport planning with other policy domains

Synergistic scenario planning integrates transport planning within broader planning efforts towards carbon neutrality at the city and regional scale.[98] Such integrative tools conceive transport as one aspect in the large-scale socio-technical transformation of the energy, transport, industry and building sectors.[99] Synergistic scenario planning creates bridges between different policy domains that play a role in securing greener urban futures—including transport—and helps align actors' interests to build partnerships and share goals. The involvement of stakeholders is essential to identify drivers of change (e.g. energy prices, technological costs, people's preference for different transport modes) and to assess the feasibility of different scenarios. Urban dwellers' participation in transport planning is essential to avoid an over-emphasis on a small set of transport options and one-size-fits-all prescriptions that bear very little relevance to the implementation sites.

Practical experiences show that scenario planning for land-use and transport decisions has mixed results, especially without inclusive and participatory frameworks, clear implementation plans and resources, and adequate institutional structures.[100] Most practical experiences in scenario planning are in North American and European cities, where they rarely address the challenges of informality and rapid urban growth. As a result, most future visions on urban transport emphasize technological solutions, whose effectiveness is not always proven: freight or passenger transport with small airborne vehicles such as drones, flying cars or taxis;[101] smart traffic management systems that enable vehicle-to-infrastructure communication to ease congestion and facilitate intermodal travel;[102] and autonomous vehicles, connected cars on shared mobility platforms.[103]

However, the most effective responses are relatively low-cost and/or low-tech: better planning regulations; introduction of low-emission zones; support for cycling and walking; and rapid transit systems. Low-cost responses are particularly relevant in highly unequal cities where most people do not have access to private cars or public transport and thus rely on walking, cycling or informal taxis. The COVID-19 crisis has also fostered low-tech, low-cost measures such as pedestrianizing streets, expanding cycle lane networks or implementing low-traffic neighbourhoods as means to encourage safer, healthier and less polluting forms of travel.

In conclusion, scenario planning is a promising tool to navigate uncertain futures. Still, it only works alongside

Low-tech interventions should have a prominent role alongside other widely promoted high-tech solutions

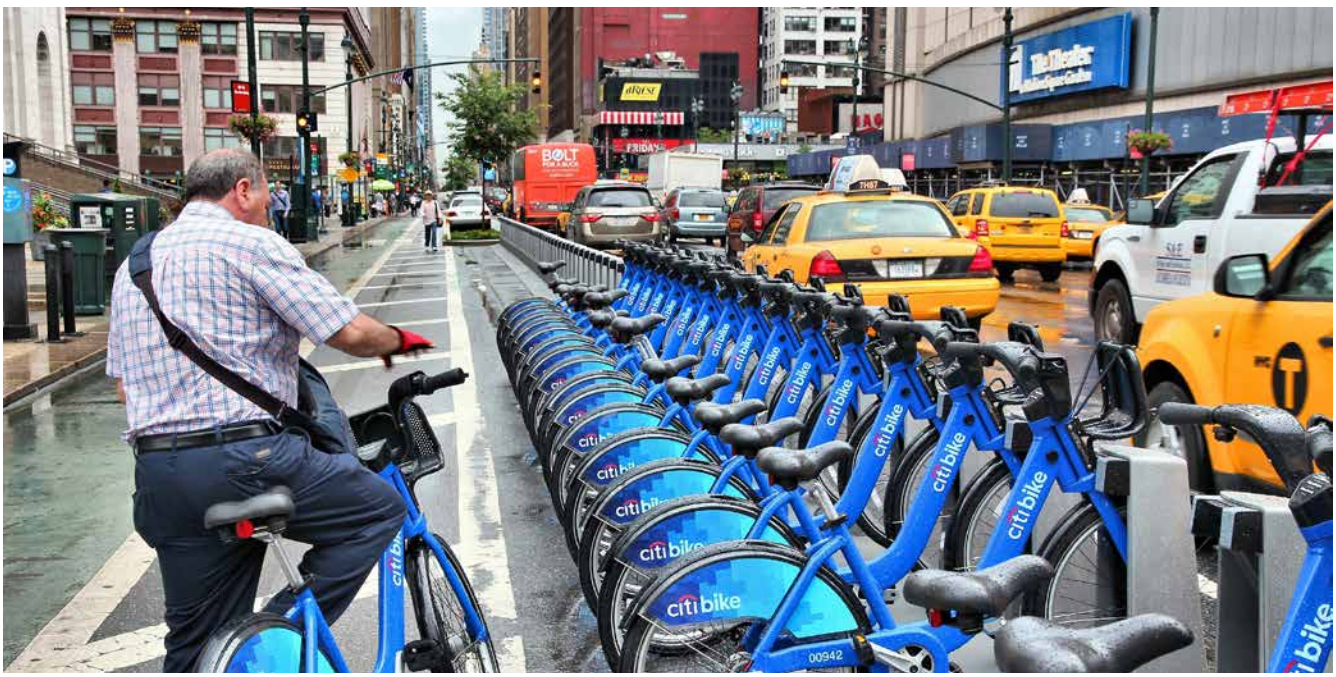
inclusive, participatory processes that ensure all urban dwellers— particularly those with limited access to different travel options—can take part in the definition of urban futures.[104] Travel demand forecasting tools do not easily capture many mobility practices, such as informal transport and active modes of travel. Low-tech interventions should have a prominent role alongside other widely promoted high-tech solutions. Future transport planning will need to integrate, above all, adaptability and flexibility through consistent evaluation frameworks to guide decisions in a context of uncertainty.[105] Importantly, holistic transport planning approaches and frameworks such as Sustainable Urban Mobility Plans (SUMPs) as well as the embrace of concepts like the 15-minutes neighbourhood (discussed in Chapter 6) should be viewed and promoted as vital to securing a greener urban future.

5.2.3. Inclusive mobility at the forefront

Achieving greater justice and sustainability through future transport and mobility planning will require decision-makers to recognize that not everyone can access transport and mobility options in the same way. Thus, there is greater interest in developing transport strategies with groups whose experiences have traditionally not been included in traditional transport planning, which tends to assume that users of urban mobility are able-bodied males.[106] For instance, not everyone can shift transport options depending on their income or avoid travel entirely. During the COVID-19 pandemic, informal and essential workers in urban areas had no choice but to go to work on public transport.

Local governments can make a big difference in opening cities and urban areas to cater to diverse mobility needs with minor neighbourhood investments. Simple measures make a tangible difference, such as street and sidewalk repairs, pavement widening, ramp installation, step-free access to public transport, and well-designed wayfinding signage to facilitate access for people with specific mobility needs, from wheelchair users to caregivers with pushchairs to older persons to the visually or aurally impaired.

In addition to physical infrastructure improvements, affordable fares facilitate public transport access. Many cities have free or subsidized fares for low-income riders, youth and older persons. Tallin (Estonia) introduced free transport for its residents in 2013. The initiative was so successful that it was expanded nationally in 2018. However, undesirable effects included shifts from active travel to public transport



Bicycle sharing station in New York © Shutterstock

for some users, new pressures on the network to meet new users' needs, and limitations on revenues for further improvements.[107]

Safety is vital to sustainable mobility. Ensuring that streets and public transport are safer for everyone is a challenge that requires urban design interventions

Safety is vital to sustainable mobility. Ensuring that streets and public transport are safer for everyone is a challenge that requires urban design interventions. Some groups like women, sex workers, and gender and sex non-conforming people face exclusion from public spaces and roads because they are unsafe. Several cities have started to act on those issues, particularly addressing street harassment against women and harassment in public transport. Torreón, Mexico, has partnered with women's groups, municipal workers, and UN Women to develop new mobility regulations that safeguard women and girls' safety in public transport. The mobility regulations serve as a code of conduct for transport authorities, staff, and passengers and entails compulsory training on gender violence for public transport workers. [108] The city of Cairo, Egypt, includes gender assessments in transportation design, facilitating the creation of safer routes for women using public transport. These efforts range from collecting new data (e.g. sex-disaggregated data that reflects women passengers' experiences), promoting women's view in the decision-making process and designing gender-responsive interventions (e.g. last-mile safe footpath to bus stops).[109]

5.2.4. Integrating informal transport systems

Often, mobility planning tools struggle to account for informal transport systems. Informal transport and paratransit systems (e.g. shared taxis operating based on riders' destination and minibuses operating on fixed routes) are central to support the mobility needs of millions of people.[110] In cities like Kayseri, Turkey, the informal sector may account for 60 per cent of urban trips, and in some African cities such as Dakar or Freetown, over 90 per cent of daily trips depend on informal transport.[111] The rise of private-sector app-based ride-hailing services such as Careem, Grab and Uber poses challenges with regards to the nature and dynamics of formalization that is required in urban transport.

Informal transport systems exist alongside or instead of formal, public or private transport provision systems. Whether run by independent operators or larger cartels, informal transport typically operates outside regulatory frameworks as few developing countries have resources to enforce rules and requirements for transport sector.[112] However, operators often self-regulate through "unions" that "police" operations on specific routes or terminals.

Informal and paratransit systems tend to be used by the urban poor and the middle class, especially when public transport options are limited. They play a fundamental role in filling the gaps in peripheral urban areas, which are often overlooked in public transport networks. For example, mothers and caregivers in Abidjan tend to use informal collective transports to drop their children at school.[113] Informal transport offers urban dwellers different vehicle types, including minibuses, collective taxis and both motorized and non-motorized two or three-wheelers (Table 5.3). However, the informal transport sector faces safety and pollution issues because vehicles are not regularly replaced or maintained.

Informal transport networks should be integrated into future transport planning, with adequate provisions to support improvements in safety and reduction of polluting emissions. Combining formal and informal transport provision may be effective. Informal transport networks can link urban dwellers living in underserved areas to public transport hubs, avoiding the need to expand public infrastructure networks and building on what already exists.

Countries such as Senegal and the Philippines have introduced stricter regulations to force minibus drivers to buy less polluting vehicles. While these measures can encourage the decarbonization of popular transport modes, they also jeopardize the livelihoods of drivers and operators, for instance, without adequate subsidies and financial incentives to switch vehicles. Local governments can work with operators, drivers, and passengers to plan safer, more efficient routes or to facilitate upgrades to cleaner vehicles and fuels.

Informal transport networks should be integrated into future transport planning, with adequate provisions to support improvements in safety and reduction of polluting emissions

Table 5.3: Informal transport examples

Informal transport mode	Usage	Examples
Minibus/Jitney	Operates on fixed routes, following semi-fixed schedules. Can accommodate 12 to 24 passengers and operate across long distances (beyond the neighbourhood)	Examples of minibus/jitneys include *cars rapide* (Dakar), matatu (Nairobi), jeepneys (Manila), dolmus (Istanbul)
Microbus/Pick-up	Operates on fixed routes, following semi-fixed schedules. Can accommodate 4 to 11 passengers and operate across long distances (beyond the neighbourhood)	Examples of microbus include *mikrolets* (Jakarta), *Selman* (Hanoi)
Three-wheeler/Motorcycle/Collective Taxi	Operates on variable routes at variable schedules, demand driven. Can accommodate 1 to 4 passengers and operates at the neighbourhood level).	Examples of three-wheelers include *bajajs* and *bemos* (Jakarta), rickshaws (Dhaka)
Pedicab/Horse cart	Operates on variable routes at variable schedules, demand driven. Can accommodate 1 to 6 passengers and operates at the neighbourhood level).	Examples of pedicabs include *becaks* (Jakarta) Examples of hores carts include *calesas* (Manila)

Sources: Kumar et al, 2021; Cervero, 2000.

Policymakers face three options to manage the informal transport sector:[114]

- Ban operations and run the risk of displacing service provision to new locations.
- Accept the existence of informal transport systems without addressing the challenges they pose, particularly air pollution and congestion.
- Integrating and improving existing systems into urban and metropolitan mobility planning and service provision.

The third option will be the most effective to deliver inclusive and sustainable mobility.

5.3. Embracing Resilience for Greener Urban Futures

The 5th IPCC Assessment Report highlighted the vulnerabilities of urban areas to climate change impacts and identified opportunities for incremental and transformative adaptation.[115] The Special Report on Global Warming of 1.5°C pointed towards risks in urban areas, particularly in unplanned and informal urban settlements.[116] The contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate states that human influence on the climate system is now "an established fact" and its impacts are already apparent.[117] Urban areas will be affected directly (for example, by frequent extreme climate events, sea-level rise and increased probability of flooding) and indirectly (for example, by large-scale ecosystem and social processes such as migration or disruption to supply chains). New findings on the relationship between regional and urban climate suggest that unplanned and unsustainable urbanization patterns also exacerbate impacts such as heatwaves and precipitation.

5.3.1. Safety and resilience in urban policy

Safety and resilience have become essential themes in urban sustainability policy. The Global Commission on Adaptation argues that an investment of US$1.8 trillion from 2020 to 2030 could generate US$7.1 trillion in total net benefits.[118] Urban areas already require investments in climate-resilient infrastructure to improve housing, transport, water, sanitation, drainage and waste management. Whether or not urban areas can meet adaptation challenges, adaptation actions will not happen without consequences and differential impacts are already palpable across urban areas.

Adaptation and resilience agenda is interlinked with development agendas. The 2030 Agenda for Sustainable Development tied "sustainable cities and communities" to both safety and resilience (SDG 11). The New Urban Agenda highlighted cities' importance to "reduce vulnerability, build resilience and responsiveness to natural and human-made hazards and foster mitigation of and adaptation to climate change." Adaptation will likely be a salient challenge for cities in the 21st century.

Adaptation is also redefining the urban economy. Local and regional governments, businesses, and citizens will seek to protect human lives, livelihoods and material assets. Many are working to transform adaptation burdens into financial and innovation opportunities. However, adaptation and resilience are intrinsically linked to the need to deliver fairer, more inclusive urban futures.

adaptation and resilience are intrinsically linked to the need to deliver fairer, more inclusive urban futures

5.3.2. Inequitable distribution of environmental burdens

Disadvantaged groups bear a disproportionate burden of environmental risks in cities. The urban poor worldwide experience higher exposure to health risks through lack of access to clean water[119] and exposure to outdoor air pollution,[120] toxic materials,[121] waste,[122] and indoor air pollution due to limited access to clean fuels.[123] Low-income neighbourhoods also frequently have less access to environmental resources, such as green space[124] and clean energy.[125] The depictions by country in Map 5.1 to Map 5.4 paint a highly unequal landscape of access to water and sanitation.

The risks to the urban poor are likely to worsen in the future. The urban poor are more vulnerable to the impacts of climate change as they often live on sites that are more exposed to extreme weather events (e.g. flooding, landslides, extreme heat and cold) and with limited access to secure housing and other protective amenities (e.g. health care, water and sanitation services, and social protection).[126] Climate impacts are linked to many different risks, which disproportionately affect informal settlements and low-income neighbourhoods, such as water scarcity[127] and exposure to infectious diseases.[128] Groups that are exposed to these risks include children,[129] women,[130] the elderly[131] and communities suffering racial or ethnic exclusion.[132] Environmental risks also disproportionately impact groups already experiencing a lack of security, for example, due to low and unstable incomes, exclusion from social protection systems, or exposure to violence, including urban refugees[133] and migrants.[134]

Flooded street in Dhaka, Bangladesh © Shutterstock

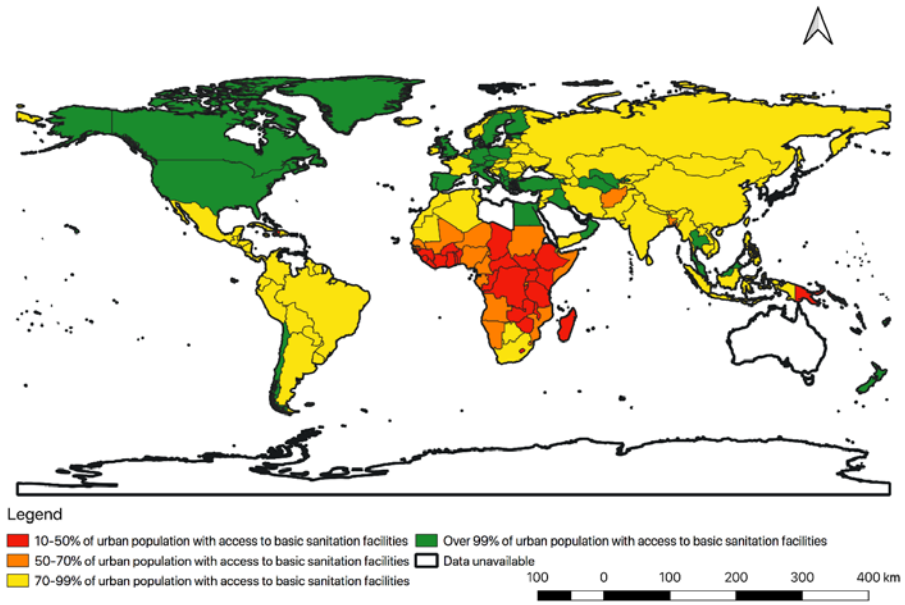
Box 5.4: Urbanization and climate impacts

The latest IPCC report documents the impacts of climate change on urban areas, which will suffer extreme events such as heatwaves, sea-level rise, storm surge from tropical cyclones and intense rainfall. The combination of more frequent extreme events and future urban development suggests that climate change adaptation has become the main priority for local governments.

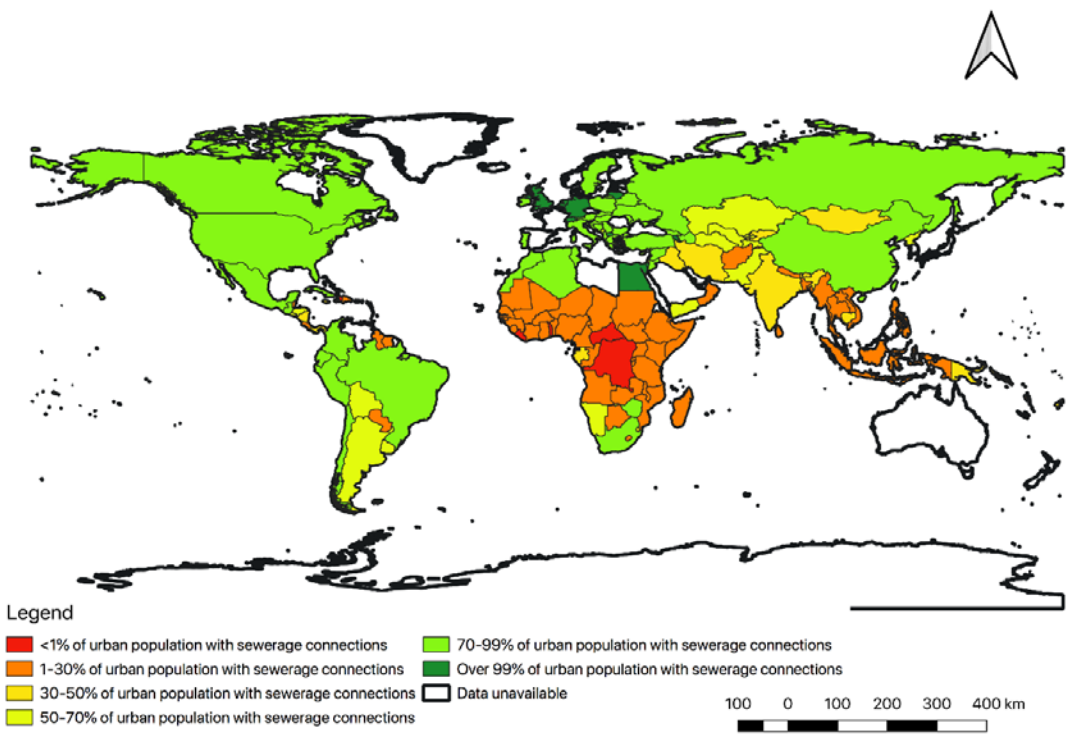
Moreover, the latest IPCC report documents the complex interactions that influence the expression of climate impacts in urban environments, for example, in the heat island effect or the alterations of the water cycle in urban environments. It highlights the compounded risks that are also likely to affect cities, such as the intensification of warming and mean precipitation. Additionally, a combination of increases in relative sea level and storm surge from tropical cyclones increases the probability of coastal city flooding.

Source: Global Commission on Adaptation, 2019; IPCC, 2021.

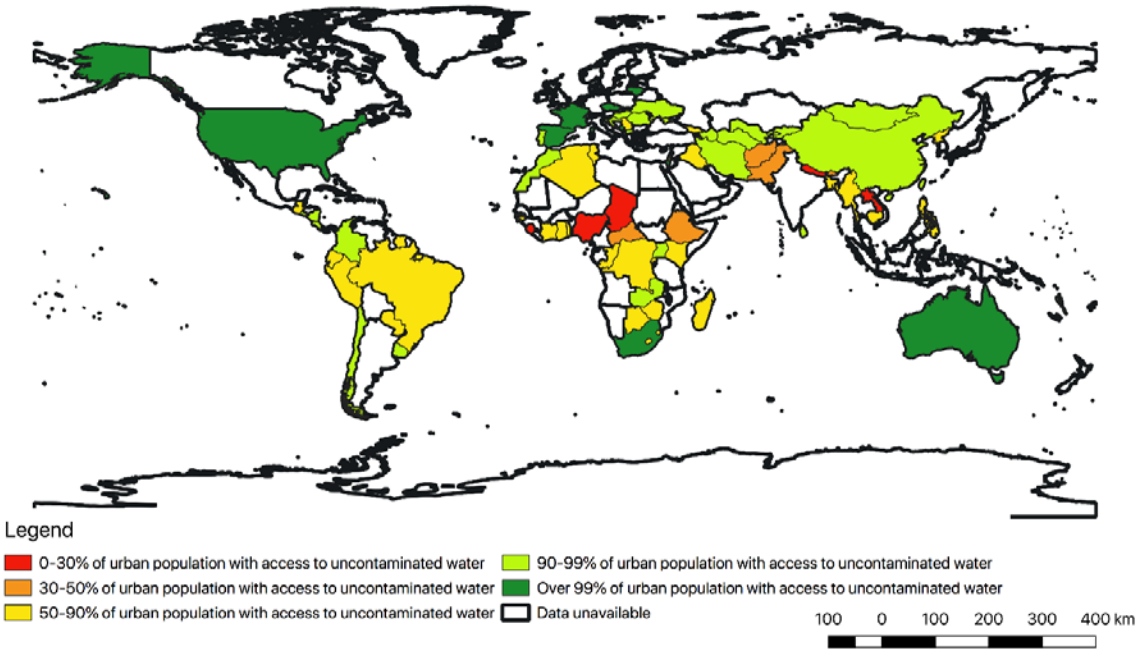
Map 5.1: Percentage of urban population with access to basic sanitation facilities by country



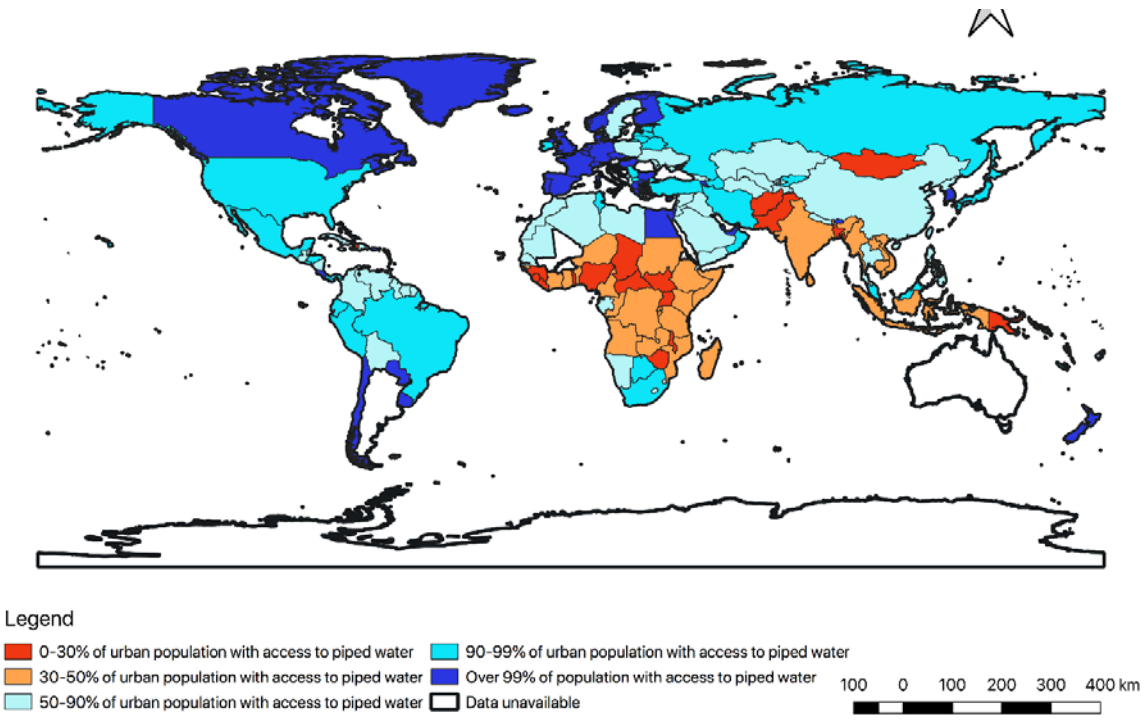
Map 5.2: Percentage of urban population with sewerage connections by country



Map 5.3: Percentage of urban population with access to uncontaminated water by country



Map 5.4: Percentage of urban population with access to piped water by country



Source: Data Analytics Unit, UN-Habitat

5.3.3. Urban climate adaptation planning

Urban climate adaptation planning is "the purposeful development by local governments of activities and strategies designed to reduce the effects of climate change on natural, built, and social systems."[135] There are multiple options for climate adaptation in cities, such as water management, land-use planning and green infrastructure.[136] Cities have no choice but to adapt to climate change.[137] A new paradigm is emerging in adaptation planning that recognizes climate change as an ongoing, dynamic phenomenon in contemporary societies requiring multiple actions, feedback and adjustments. As the well-being of the city entails multiple dynamic processes (economic transactions, social interactions, resource use) and a diverse set of actors, the pursuit of a climate-resilient future requires adaptation planning that works for everyone (Figure 5.4).

the pursuit of a climate-resilient future requires adaptation planning that works for everyone

A central challenge to this paradigm is the amount of available urban land and how it is used, which influences the potential to address environmental impacts as well as urban inequality.[138] Global data on urbanization patterns indicate a continuous rate of urban expansion, also known as urban sprawl, as cities consume land at a faster rate than the growth of their populations. As such, building denser urban areas is generally understood as a more sustainable urban growth model.[139] However, density also influences the patterns of infrastructure distribution and shapes urban inequities (see Chapter 2).[140]

Planning for resilience must also take into account the physical and institutional context of urban planning. A recent study of climate-resilient cities in India examined urban climate action plans developed by thirteen municipal corporations (Table 5.4).[141] Such plans usually emerge with support from national or international funding or as part of broader developmental agendas. While each plan focuses on different problem areas (such as energy, carbon sequestration or urban green spaces), these plans rarely reflect the contextual peculiarities of the city but rather reproduce statements made by the National Action Plan on Climate Change (NAPCC). Most of these plans rely on technological and built infrastructural interventions while overlooking the potential of nature-based solutions or consideration of local knowledge bases, ecologies and processes.

Figure 5.4: Characteristics of inclusive adaptation planning

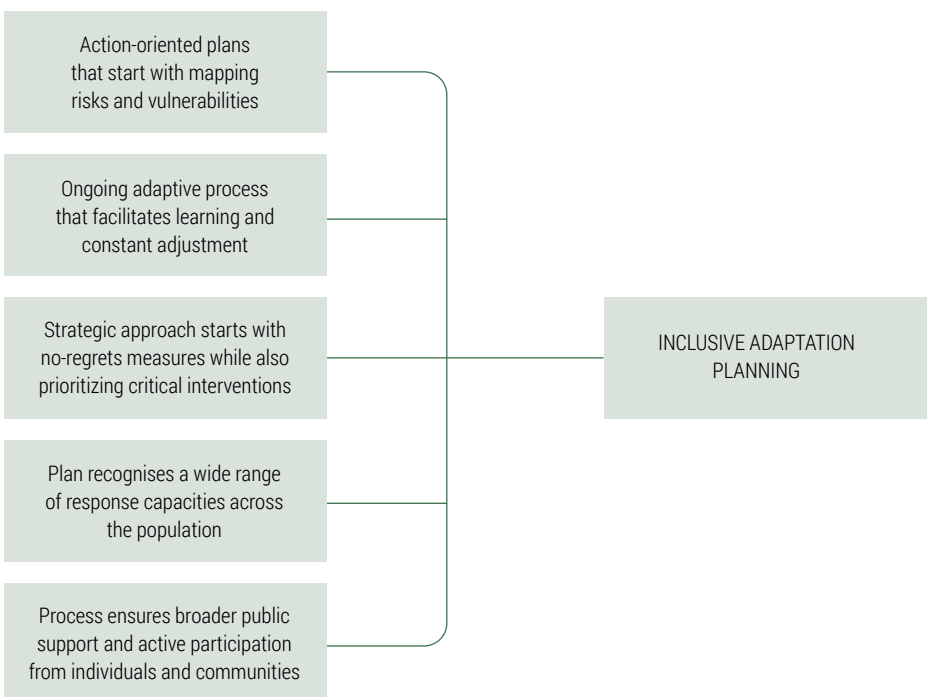


Table 5.4: Climate planning in Indian cities

Type of plan	Cities	Problem areas	Broader influence on urban agenda	Governance issues represented	Governance issues missing
Carbon neutral city plans	Pune	Renewables, Carbon sequestration	NAPCC – National Action Plan on Climate Change	Urban agenda State centre relationships	International relationships
City development plans	Nagpur	Pollution Water Gardens Open spaces Disasters Climate change Sustainable development	PM Council on Climate Change	Urban agenda	State/Centre relationships International relationships
Resilient city plans	Gorakhpur Indore Chennai Kolkata Surat Vizag	Water Health Disasters Solid wastes Energy Transport Low carbon Green cover Resource stress Non renewables	NAPCC/SAPCC/Asian cities climate resilience network/ ADB funding strategy	Urban agenda State centre relationships	State/Centre relationships International relationships
Disaster management plans	Koraput	Floods Fire Drought Heat	Disaster Management Act, 2005	Urban agenda State/centre relationships	International relationships
Environment status reports	Chandrapur Nanded	Pollution Solid waste Mining Health	MoEF directives MPCB directives	Urban agenda	State/Centre relationships International relationships
Heat action plans	Ahmedabad Hazaribagh	Heat	Disaster Management Act, 2005	Urban agenda State/Centre relationships	International relationships

Source: Unnikrishnan and Nagendra, 2021.

5.3.4. Tools to deliver climate-resilient urban futures

Urban adaptation responses often emphasize the development of climate-resilient infrastructure.[142] Climate-resilient infrastructure is planned, designed, built, and operated in ways that take into account climate-related variability to withstand future climate-changed conditions.[143] Resilience will involve measures related to the design of new infrastructures and the retrofitting of old ones, from ICT networks to housing. Digitalization, for example, is increasingly seen as mediating more responsive infrastructure systems but exposes infrastructures to new risks and dependencies.

Standard urban adaptation measures include water storage, flood defences, and water supply and sanitation, alongside housing and spatial planning. For example, basic infrastructures such as water and sanitation remain a significant concern because of their impact on achieving other SDGs and because they impact directly on people's ability to cope with disasters. As Map 5.1 to Map 5.4 show, there is still a substantial deficit in water and sanitation access in several regions of the world, especially Sub-Saharan Africa. Figure 5.5 and Figure 5.6 further shows that urban populations have the highest rates of access. Still, these statistics hide highly uneven patterns of access, as heterogeneous systems of provision dominate the urban environment. Moreover, the definitions of improved access may range widely and includes many people who depend on water kiosks or tanks or having shared facilities: facilities may exist in the proximity but that does not automatically guarantee that urban populations have their needs covered.[144]

Figure 5.5: Access to basic water facilities

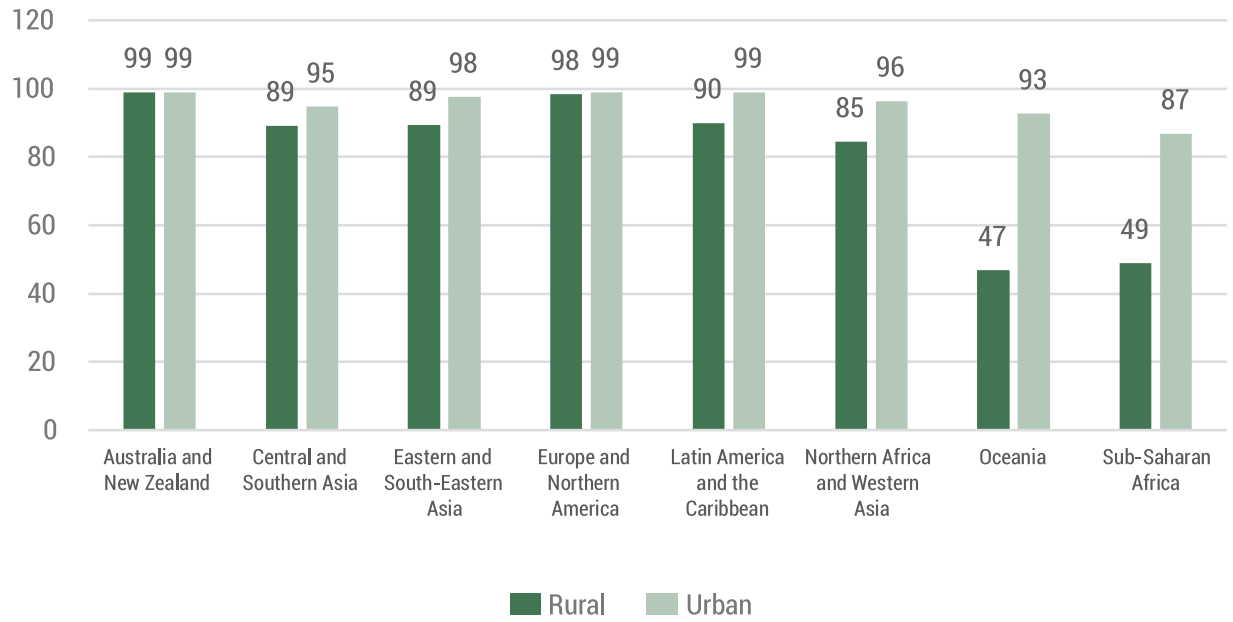
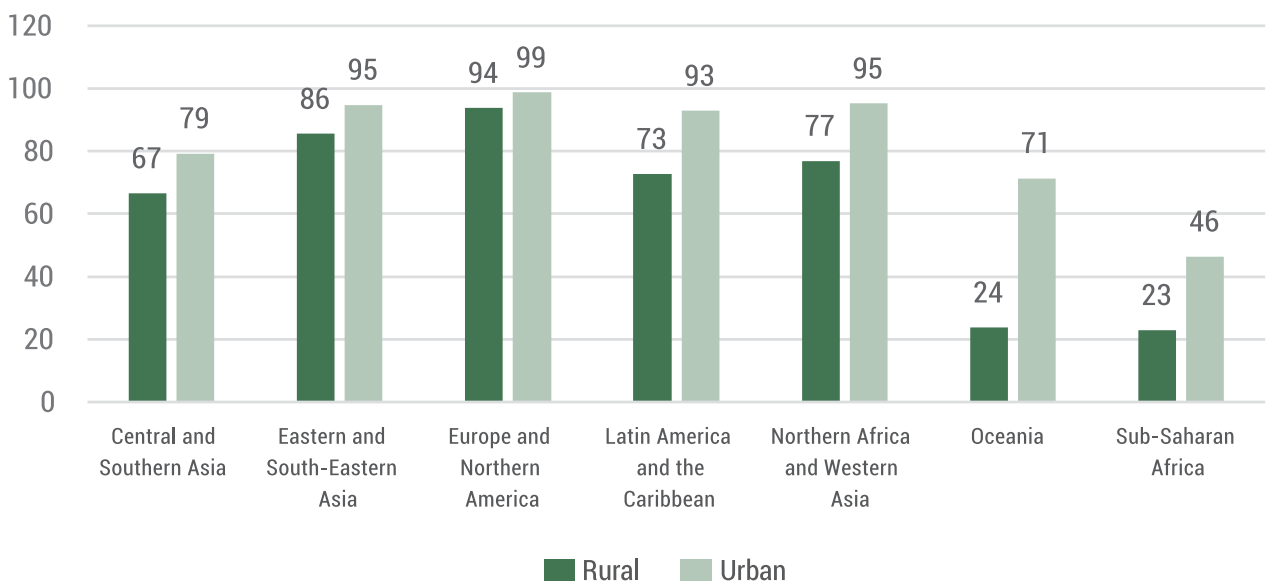


Figure 5.6: Access to basic sanitation facilities



Source: Data Analytics Unit, UN-Habitat.

Urban adaptation also requires a broader range of measures, including the development of prevention measures to tackle vulnerability and develop early warning systems, alongside efforts to contain and mitigate disasters, and measures to facilitate rebuilding and adjustment—for example, through the development of nimble infrastructure networks. Urban adaptation needs to be considered at the planning stage, in new infrastructures, in retrofitting existing infrastructures, and in examining the additional infrastructure needs that climate change generates. A 'capability' approach to urban design seeks to understand actions in the built environment that build resilience while also delivering co-benefits (Table 5.5).

Community-based adaptation (CBA) represents interventions led by communities to build resilience against the impacts of climate change[145]. CBA is especially important in settings where formal institutions overlook the vulnerability of informal settlements and urgent action is required to address issues like flooding and service delivery[146]. CBA helps recognizing local capabilities and can be conducted through various participatory methods, including participatory mapping,[147] vulnerability indices,[148] community engagement in risk communication,[149] and community-based vulnerability assessments.[150]

Urban adaptation needs to be considered at the planning stage, in new infrastructures, in retrofitting existing infrastructures, and in examining the additional infrastructure needs that climate change generates

Participatory design and mapping exercise in Kilifi, Kenya © Julius Mwelu/ UN-Habitat

Table 5.5: Maintaining build environment capabilities for climate change mitigation and adaptation

Built environment capabilities	Climate change mitigation strategies	Climate change adaptation strategies
Health		
Outdoor environmental quality at multiple scales (global to neighbourhood)	Minimize environmental costs (proximate and distal) of all infrastructure	Protect proximate and distal landscapes and built environment from climate change impacts (e.g. heatwaves, droughts, floods, storms etc.)
Indoor environmental quality including air, sound and light quality, physical integrity	Ensure low-carbon building does not compromise indoor environmental quality	Enhance access to spaces of high indoor environmental quality; ensure efforts to enhance indoor environmental quality do not impose stress on outdoor environmental quality
Outdoor thermal adequacy	Seek to reduce outdoor thermal stress imposed through the built environment, including microclimatic characteristics	Protect or enhance mechanisms for low-carbon outdoor thermal comfort
Indoor thermal adequacy	Recognize potential implications of mitigation policy on indoor thermal adequacy	Enhance access to domestic low-carbon thermal comfort control; ensure efforts to enhance indoor thermal comfort do not negatively affect outdoor thermal comfort and/or generate additional greenhouse gas emissions
Physical safety		
Home	Building and operation practices that provide high-quality, low-carbon, affordable housing	Minimize vulnerability of permanent and temporary residential areas to extreme climate events and long-term impacts
Care settings (e.g. care homes and extra-care homes)	Building and operation practices that provide high-quality, low-carbon care provision	Minimize vulnerability of care settings to extreme climate events and long-term impacts
Work/school/public life	Building and operation practices that provide high-quality, low-carbon infrastructure for employment, education and public life	Minimize vulnerability of workplaces, schools and public institutions to extreme climate events and long-term impacts
Accessibility and mobility	Implementing low-carbon, safe and accessible mobility services; reduce non-human-powered mobility needs overall	Ensure low-carbon transportation infrastructure, including human-powered mobility systems, is accessible and functioning through extreme climate events
Cultural vitality		
Public spaces	Building high-quality, low-carbon public spaces (including protecting adequate green space) designed to nurture public and cultural life	Ensure protections and inclusive access for public space in order to meet the diversity of needs this space addresses in the face of extreme climate events and long-term impacts
Sacred sites and cultural amenities	Avoid damaging sacred or culturally significant sites or amenities when developing low-carbon infrastructure; reduce emissions related to sacred sites or cultural activities	Develop meaningful strategies for managing the irreversible loss of sacred or culturally significant sites (including landscapes)
Essential services		
Water and sanitation	Ensure low-carbon, safe and adequate water and sanitation services	Protect and/or redesign water and sanitation services for resilience in the face of extreme climate events and long-term impacts
Food systems	Invest in human and material infrastructure to reduce greenhouse gas emissions of food systems through the entire supply chain	Protect and/or redesign food systems infrastructure (including for subsistence production) for resilience in the face of extreme climate events and long-term impacts
Public health	Ensure adequate low-carbon and accessible public health, including minimizing transportation needs	Ensure public health infrastructure (and access to it) is protected from extreme climate events or long-term impacts

Source: Klinsky and Mavrogianni, 2020.

A key element of adaptation planning is the identification of vulnerable urban populations. Vulnerabilities are often linked to inequalities. Urban populations may see their capability to respond to climate change compromised because of their gender, age, ability, caste, race, sexual orientation and gender conformity. Many of these identities have been observed to have the potential influence aspects of institutional, cultural, and structural environments that affect people's everyday lives. However, each experience must be understood in its own unique way.

The slogan "nothing about us without us"[151] emerges from an Eastern European tradition of political struggles. The slogan has served many groups that are identified as vulnerable to claim their voice in policy processes that purport to respond to their needs. The disability rights movements, for example, use this slogan as a means for people to claim a voice in political debates and demand control over their lives, which may be limited by the dependencies generated by powerlessness, poverty, and institutionalization.[152] An open city that responds to the needs of people with disabilities—and hence everyone—would require the active involvement of those very people.[153]

resilience depends not only on facilitating innovation but also on not adding to existing burdens

The slogan has also been adopted by other groups claiming their right to the city, from waste pickers to sex and gender non-conforming people. With this slogan, different people groups claim urban space and display their capacity to influence their environment and quality of life. Moreover, the slogan is a powerful reminder that resilience depends not only on facilitating innovation but also on not adding to existing burdens. The demands for politically redressing existing injustices in the urban environment call for collaborative processes that build resilience through challenging the drivers of inequality.

Informality shapes the vulnerability of people, and as urban areas continue to grow, the gap between infrastructure available and needs will likely grow. However, perhaps the most significant challenge faced by people living in informal settlements is the recognition of their capacities, and sometimes, even their existence. Yet, their capacities in community-led profiling of their neighbourhoods holds great promise (see Chapter 10). There is a need to understand what just urban adaptation—or, more generally, a just transition—looks like from the perspective of an informal settlement.

Often, relatively cheap and straightforward responses (such as waste collection to reduce flooding, housing designs that facilitate cooling, green public space, transitions to streetlights with solar power, access to clean fuels, and collective maintenance of green spaces, among other measures) may have an enormous impact. Yet, climate finance tends to concentrate on large, prestige-oriented infrastructure projects.

Another challenge which has already highlighted in the previous chapters of this report is the exclusion of the informal economy. Governing institutions tend to exclude it without recognizing the potential supporting role that informal economy opportunities may provide to ensuring an inclusive green growth, one that also supports social groups already suffering discrimination, exclusion and poverty. Notably, past research has shown that only 25 per cent of countries (or 15 of 60 countries) make explicit mention of the informal economy in their national green economy plans.[154]

Lastly, it is important to take cognizance of the paradigm shifts in climate change planning processes. While research on climate change planning initially emphasized local authorities' capacities and institutions, the focus has shifted progressively towards planning as a collaborative and collective project.[155] Multiple actors, such as civil society, the private sector, representatives of professional associations and academia, communities, and citizens, are involved in collaborative planning processes that can deliver adaptation planning (see section 5.5.2 for a discussion of various means of involvement).

5.3.5. Just urban resilience

There are two interpretations of resilience: one is functional and relates to optimizing the process of recovery; the other focuses on the structural challenges and relates to coupling endurance and recovery to demands for justice. Part of the challenge relates not only to the complexity of resilience as a problem to be addressed with current resources but also to the proliferation of climate responses that only entrench and reproduce existing inequalities, and that safeguard some populations at the expense of others:

> *Climate justice means calling out "false" solutions to mitigating climate change that seek to ease the energy transition for the fossil industry and privileged populations. Many of these false solutions involve mining, new infrastructure and exploitative profit and labour schemes that will generate further environmental and climate injustice.*[156]

In that context, delivering resilience is closely linked to our ability to challenge structural drivers of discrimination—be it discrimination resulting from historical legacies of racism, colonialism; discrimination related to sex, gender, age, ability; or other less visible forms of discrimination encountered in everyday life. In that sense, building

resilience requires engaging with the historical processes that have produced vulnerability in contemporary cities. Many of these vulnerabilities are manifest in the spatial configuration of cities, for example:

- The spatial division in urban areas between neighbourhoods that are better serviced than others, with lower-income populations being hosted in areas where access to basic services such as water, mobility, or energy are compromised.[157]

- The creation of areas of privilege safeguarded at the expense of others, for example, in the creation of new enclaves of privilege. In Africa, for example, there is a proliferation of "urban fantasies" in urban projects and masterplans that do not only fail to recognize the realities of urban development in African contexts but also impact negatively on the lives and livelihoods of urban populations, even when those projects are not even constructed.[158]

- The privatization of services and public space, reducing the urban commons for everyone.[159]

- The displacement of people who are prized out of certain neighbourhoods, after the environmental quality of those neighbourhoods raises local prizes in multiple manifestations of gentrification.[160]

- The differentiation of areas with different levels of risks,[161] that often end up accommodating vulnerable populations and new migrants.[162]

- The siting of large infrastructures in areas considered of less value, normally inhabited by less powerful black or indigenous communities—and the creation of sacrifice zones[163] in processes long documented in indigenous struggles and environmental racism that claim for different frames of reference beyond development.[164]

Inclusive greener futures can be secured though active practices of building resilience through community innovation and collaborative planning (see section 5.5) and through the prevention of processes that negate peoples' lives and existence through the implicit privileging of some lives over others—what the philosopher Achille Mbembe has called necropolitics.[165] These are all processes directed through infrastructure and spatial planning and through policymaking, which can be actively prevented in the quest for just urban adaptation (see also section 5.5.1).

5.4. Nature-based Solutions and Environmental Futures

Nature-based solutions (NBSs) are a potential mechanism to manage the impacts of climate change in urban spaces. NBSs are promising in the context of halting biodiversity loss and restoring urban ecosystem services in economically viable ways.[166] The International Union for Conservation of Nature (IUCN) defines NBSs as "actions to protect, sustainably manage, and restore (create) natural or modified ecosystems" that simultaneously address social challenges, providing both human well-being and biodiversity benefits.[167] The European Commission explains that because they are inspired and supported by nature, NBSs are cost-effective and provide environmental, social, and economic benefits.[168]

Bosco Verticale seen from the Biblioteca degli Alberi (BAM), park located between Piazza Gae Aulenti and the Isola district, Milan, Italy © Shutterstock

Table 5.6: Nature as a response to societal challenges

	Definition	Examples
Ecosystem services 	Focus on the benefits that the natural environment and ecosystem provide to humans and societies	▪ Regulating the provision of water, food and services ▪ Facilitating nutrient cycling
Biomimicry 	Biomimicry involves approaches that emulate nature to develop responses to human challenges, for example, in urban design	▪ Fibbers that mimic spiders' silk ▪ Imitation of algae for water purification ▪ Building materials that imitate the structures of mycelium
Ecosystem-based adaptation and mitigation 	Use of ecosystem services to reduce vulnerabilities to climate change impacts and to reduce carbon emissions	▪ Restoration of coastal habitats such as mangroves ▪ Restoration of wetlands and peatlands
Green and blue infrastructure 	The vegetational- and water-related elements that structure the built environment and provide additional services	▪ Involve a range of infrastructures including blue (rivers, canals, ponds, wetlands, floodplains, water treatment facilities) and green (trees, lawns, hedgerows, parks, fields, urban forests)
Ecosystem approaches 	Strategies that focus on the integrated management of land and nature, which consider humans part of the ecosystem	▪ Activities that involve people, value ecosystems, and understand ecological processes

NBSs highlight the importance of biodiversity and ecosystems to address urban challenges such as adapting to climate change, enhancing food security and or facilitating water access. NBSs are aligned with the United Nations 2030 Agenda for Sustainable Development and follow a tradition of designing with nature to respond to human challenges (Table 5.6).[169]

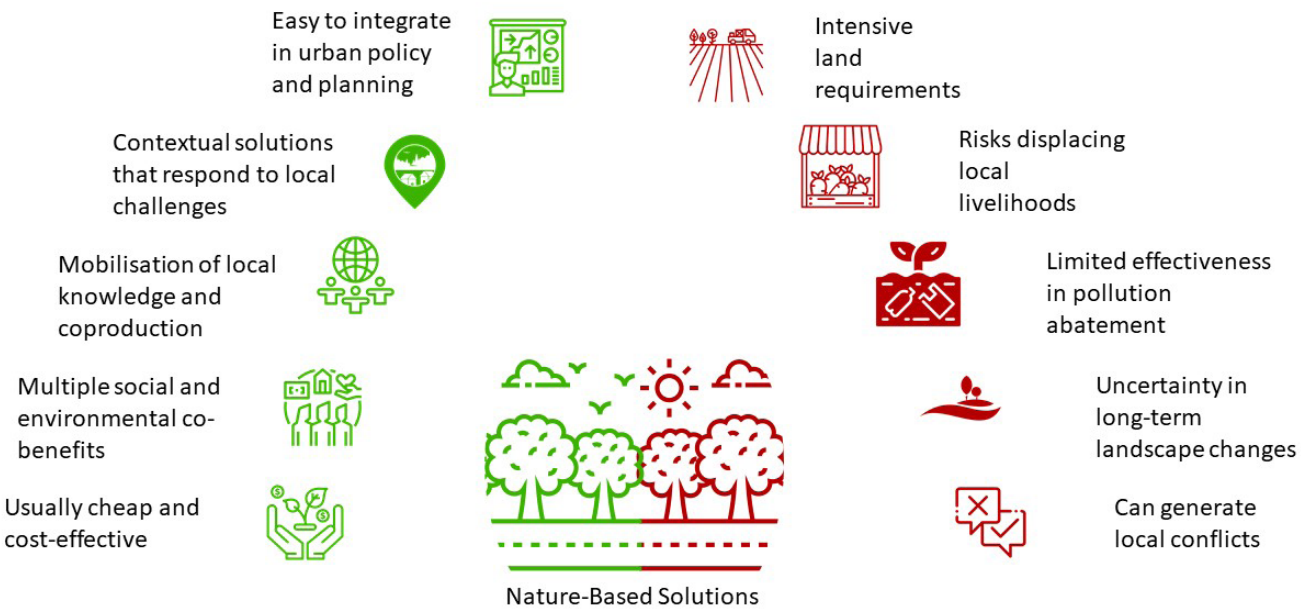
While NBSs offer several benefits, they can also pose some challenges for urban areas. First, NBSs such as greening and artificial wetlands for sewage treatment require significant provision of land and physical space. Land-intensive responses to environmental crises may not be practical or may generate additional challenges, especially when they displace existing land uses. Second, if not guided by a right-based approach, NBSs may displace local economies dependent upon the urban landscape—thereby perpetuating systemic or structural violence. Third, NBSs are not always the most effective means to address certain challenging problems, such as soil and water pollution. Fourth, NBSs may conflict with larger technological or economic development agendas, requiring careful integration into the region's urban planning goals. Lastly, the long-term implications of NBSs, especially in terms of social and ecological change in the places where they are implemented, remain unknown (Figure 5.7).

5.4.1. Biodiversity and ecosystem services enable urban life

Urban blue and green spaces provide multiple ecosystem services that are essential for human wellbeing, for example:[170]

- Providing basic ecosystem services, such as food and water
- Enabling cultural ecosystem services, such as recreational and spiritual benefits
- Supporting regenerative ecosystem services such as nutrient recycling, soil conservation and microclimate regulation

Figure 5.7: Benefits and limitations of nature-based solutions



Both urban sprawl and densification (due to the urban heat island effect) pose challenges to public health, natural systems and ecosystem services.[171] Rapid urbanization has placed additional demands on urban ecosystem services, thus driving a scarcity of material and biological resources. At the same time, ecosystems are functioning at reduced capacity due to pollution and extraction.[172] The pressures of urbanization and increasing population often render urban green and blue infrastructure vulnerable.[173] Urban inequalities manifest in differentiated access to ecosystem services, such as less access to green spaces and a reduced urban tree canopy for lower-income urban dwellers.[174] These inequalities can have deadly ramifications as climate change impacts urban health.

Urban planning policies across the globe continue to focus on built infrastructure and technological improvements with limited consideration of ecosystems and biodiversity.[175] For example, the large-scale conversion of biodiverse areas to farmland or housing impacts negatively on ecosystem services.[176] Moreover, urban planning rarely integrates biodiversity and ecosystem services into service and design, aside from demonstration projects.[177] Even when focusing on these challenges, urban planning tends to focus on symptomatic short-term and incremental treatments to problems that require transformative planning and long-term solutions.[178]

Integrating NBSs in policy and planning further suffers from a lack of clarity in the underlying science and the very complexity inherent in the dynamics of urban social-ecological systems.[179] NBSs may arise through collective motivation in the peripheries of cities that lack access to critical infrastructures for water, sanitation, mobility and energy.[180] However, NBSs are often perceived as inferior to centralized physical infrastructure (such as electricity networks or large waterworks) and are usually overlooked when these regions receive connectivity through more extensive city-based networked infrastructures.[181]

Rural and urban dichotomies persist, despite being challenged on the ground by substantial differences between jurisdictional and administrative boundaries, resource flows and built-up spaces.[182] Some fields of study, such as landscape ecology, have moved beyond these dichotomies to recognize gradients of rurality and urbanity—in other words visualizing landscapes where the rural melds into the urban, forming rural-urban continuums.[183] Such approaches examine peri-urban regions' social and ecological dynamics, especially in developing contexts where centralized infrastructure for critical ecosystem resources such as water and energy provision may often be fragmented, missing or deleterious. However, these approaches are still rare.

5.4.2. Building resilience with NBSs

NBSs support societal development and enhance human well-being in ways that reflect the plural cultural values of urban society while enhancing urban resilience and the capacity of cities to provide essential ecosystem services.[184] Indeed in many urban areas, NBSs have been associated with positive effects on urban biodiversity and human health.

Studies in cities in the US and India have demonstrated that daytime air temperature is significantly reduced in urban areas with a greater tree canopy cover, especially on the hottest days of the year and times of the day.[185] Globally it has been shown that green spaces within cities (such as parks or other tree lined areas) are on an average 0.94°C cooler than build up areas without greenery.[186]

NBSs involving the establishment of wetlands and green urban spaces in Italy have reduced urban flood risk with a reported 10 per cent greater reduction in downstream flood events and a 7.5 per cent reduction in peak flow when compared with non-NBS-based infrastructural interventions.[187] The success of NBSs for flood control in São Paulo (Brazil) have encouraged municipal authorities to include them in the city's Climate Action Plan in the context of stormwater management.[188] Rewilding of parts of Slovenia's Mediterranean coastline has improved soil quality, thus positively impacting the region's ability to sequester carbon and store water, as well as its overall biodiversity capacity.[189] An NBS approach adopted within Copenhagen after a 2011 flooding event was highly effective in reducing urban flood risk, though the implementation of NBSs in the city has since been highly contested.[190]

Real estate values often increase dramatically as properties get closer to urban green and blue spaces.[191] The effect of this increases may be mixed, as nature-based projects may also drive processes of urban gentrification that intensify inequalities.[192] NBSs may provide local employment and business opportunities with beneficial outcomes for society, environment and public health.[193] A recent study shows that ecosystem restoration creates 3.7 times as many jobs as oil and gas production per dollar (Box 5.5).[194]

Box 5.5: Job comparison between green and unsustainable investment types

Building efficiency creates **2.8 times** as many jobs as fossil fuels per US$1 million
Industrial efficiency creates **1.8 times** as many jobs as fossil fuels per US$1 million
Geothermal energy creates **1.7 times** as many jobs as fossil fuels per US$1 million
Solar photovoltaic energy creates **1.5 times** as many jobs as fossil fuels per US$1 million
Upgrades to existing grids create **1.5 times** as many jobs as fossil fuels per US$1 million
Wind energy creates **1.2 times** as many jobs as fossil fuels per US$1 million
Hydropower creates **1.2 times** as many jobs as fossil fuels per US$1 million

Pedestrian-only infrastructure creates **1.3 times** as many jobs as road construction per US$1 million
Bicycle-only infrastructure creates **1.4 times** as many jobs as road construction per US$1 million
Mass transit creates **1.4 times** as many jobs as road construction per US$1 million
Railways creates **0.8 times** as many jobs as road construction per US$1 million

Electric vehicle manufacturing creates **0.9 times** as many jobs as internal combustion engine vehicles per US$1 million
Battery cell manufacturing creates **1.2 times** as many jobs as internal combustion engine vehicles per US$1 million
Electric vehicle charging infrastructure creates **2.0 times** as many jobs as internal combustion engine vehicles per US$1 million

Ecosystem restoration creates **3.7 times** as many jobs as oil and gas production per US$1 million

Source: World Resources Institute et al, 2021.

NBSs, therefore, present an approach to developing sustainable solutions that focus on human well-being, while at the same time being responsive to long-term environmental changes and associated hazards.[195] Often, they provide economically viable and inclusive responses.[196] They can be integrated in planning processes that not only value nature beyond benefits and services to humans, but also incorporate diverse perspectives relating to nature and community that emerge within plural cultural contexts.[197] UN-Habitat and UNEP, with the support of European Union, is currently implementing the Go Blue Project across six counties in Kenya's coastal region (Kilifi, Kwale, Lamu, Mombasa, Taita Taveta and Tana River). The project aims to unlock opportunities in urban centres in these counties for sustained and inclusive economic growth, while mainstreaming conservation and sustainable use of the coastal and marine environment.[198]

5.4.3. NBSs for sustainable urban futures

Ecological considerations should be an integral part of urban planning processes. Integrating NBSs in urban planning and policy requires appropriate capacities to respond to the fundamental changes that societies face while keeping nature at the centre of planning processes and frameworks. The city of Manizales, Colombia, for instance, is mainstreaming biodiversity solutions into its planning policy and legal frameworks, supported by UN-Habitat and University of Michigan.[199]

NBSs can also be integrated into the circular economy to restore existing relations with nature in urban environments and incorporate nature into sustainable business models.[200] "Bioconnections" are strategies that promote reconnections between society and nature with efforts aimed at stewarding, regenerating and maintaining biodiversity and ecosystem services to support the circular economy.[201] Examples of bioconnections include traditional methods like reforestation for carbon sequestration and experimental methods like using microalgae photobioreactors to extract nutrients from wastewater, produce oil, generate biomass and electricity.[202]

The use of engineered wood or bamboo from reforested sources could create carbon sinks in urban spaces as it has been shown that materials such as bamboo can remove five to six times more carbon from the atmosphere in comparison to conventional timber-based construction material,[203] although globally, the extent to which construction materials can remove carbon emissions also depends on how forests are managed.[204]

Restoration and protection of biodiversity through greenbelts, regenerative farming, permaculture and pollinator gardens are important components of NBSs for urban planning.[205] NBSs to regulate ecosystem services include the use of compost from organic waste in urban agriculture to promote nutrient recycling, nitrogen and phosphorus recovery through cultivated wetlands that recycle wastewater, and nutrient loss reduction through stormwater drainage and rooftop gardening.[206]

NBSs can also be integrated into large infrastructural projects. For example, water-efficient cityscapes promote flood control through green infrastructure, thus reducing surface runoff, increasing groundwater retention and filtering pollutants.[207] Guidelines for integrating NBSs into urban planning must consider the sustainable sourcing of raw material required for NBSs, further involving measures for resource traceability and exchanging industrial infrastructure and other by-products.[208]

Participatory governance can support the creation of social networks to support, develop and maintain NBSs.[209] NBS-based design can support the co-creation of specially designed and equitable spaces for different social groups, addressing questions of age, ability, gender, sexual orientation, or race. A study in Berlin showed that supportive social networks facilitate the access of elderly people to green spaces.[210] Cities may have a certain potential to buffer the impacts of change, enhance human well-being and contribute to global sustainability and resilience.[211] However, these strategies require an understanding of the social, ecological and economic peculiarities of urban spaces in order to assess the suitability of proposed NBSs, beyond standalone interventions.[212] In sum, NBSs must be part of inclusive planning processes for sustainable urban futures.

5.5. Inclusive Planning Processes

Envisioning and realizing a greener urban future require inclusive planning processes. Addressing existing vulnerabilities and inequalities[213] and delivering just and transformative outcomes necessitates the involvement of diverse perspectives.[214] This section focuses on, first, identifying existing inequalities and injustices in urban environmental decision-making and, second, proposes a set of approaches to include diverse perspectives in environmental decision-making. A recent joint publication by UNEP and UN-Habitat highlights the importance of seeking equity and justice across all local environmental action and

programming—emphasizing that these considerations should not be addressed as an afterthought. The report further calls for "ensuring that those most affected by unsustainable 'business as usual' approaches are heard, that their needs are taken into consideration, but also, and crucially, that their knowledge of urban dynamics, and their capacity to partner in solution finding and city-making, are taken seriously."[215]

5.5.1. Inequalities and injustice in urban environmental decision-making

Planning for greener urban futures requires foregrounding the experiences of vulnerable groups. Yet, many disadvantaged groups lack access to the social and political processes and institutions where environmental decision-making takes place. Decision-making processes must prioritize the needs of disadvantaged populations because an urban environment that serves the needs of vulnerable people is also an urban environment that serves the needs of everyone.

However, urban decision-making processes often exclude the urban poor, who tend to have fewer resources, time and connections than established stakeholders and urban elites, even when those processes are designed to be participatory.[216] Likewise, women are often excluded from the urban planning process, partly because of gender norms concerning formal and informal political leadership and weaker representation in formal economies.[217] Migrant workers are also routinely excluded from decision-making processes, despite their exposure to socio-environmental risks.[218] Other forms of political exclusion include discrimination based on race,[219] ability,[220] sexuality[221] and socio-political background (e.g. marginalization of refugees).[222] All strategies for inclusion require careful consideration of how exclusion has shaped experiences of citizenship and belonging and how to facilitate political recognition, for example, through dialogue, the establishment of mutual respect and different forms of reparation.[223]

Sometimes environmental policies and programmes in cities lead to the entrenchment of existing inequalities and vulnerabilities is a rights-based approach is not applied. For example, investment in green urban spaces can cause negative impacts on lower-income and marginalized communities by increasing property prices and contributing to gentrification processes.[224] Infrastructure investment to build urban resilience can concentrate wealth in enclaves for the benefit of urban elites.[225] Investment on adaptation projects in cities can also lead to evictions and displacement of the urban poor and slum dwellers, resettlement on land exposed to risks, and disruption of informal livelihoods.[226] These insights align with a long-standing understanding of how urban development visions, especially formal economic and spatial plans developed through top-down and expert-led processes, often are poorly aligned with the needs of low-income groups and even directly detrimental to their lives.[227] The impacts of environmental policy on the most disadvantaged must be central to planning for green urban futures.

Sometimes environmental policies and programmes in cities lead to the entrenchment of existing inequalities and vulnerabilities is a rights-based approach is not applied

Epistemic injustice occurs in urban planning when groups and individuals in positions of formal and informal authority downplay and invalidate multiple forms of knowing and living in the world.[228] The concept is closely tied to histories of colonization, as the occupation of lands and peoples also involved the subordination of their cosmologies and worldviews.[229] In the context of environmental decision-making in cities, the legacies of such domination manifest through hierarchies of knowledge, in which some forms of knowing are consistently valued above others.

The marginalization of indigenous knowledge is one form of epistemic injustice in urban planning. On the one hand, there is growing recognition that indigenous knowledge can play a key role in building green cities by contributing to climate-responsive designs.[230] Some indigenous communities are highly vulnerable to climate change impacts, particularly those who live with and depend on local ecosystems.[231] For instance, Indigenous knowledge of weather patterns can improve early warning systems to reduce flooding.[232] Participatory mapping, or other knowledge exchange methods, can incorporate indigenous knowledge in urban risk assessments.[233]

Incorporating indigenous knowledge into environmental decision-making in cities is not straightforward. Indigenous knowledge is frequently not recognized[234] or reduced to narrowly defined policy domains (e.g. cultural heritage).[235] There is a risk that indigenous knowledge is appropriated when integrated into dominant knowledge systems without consent, through subordination within dominant knowledge systems, especially when disconnected from indigenous values.[236] Addressing epistemic injustice is not only a question of the revaluation of indigenous knowledge systems. It is also a question of recognizing the occupation of indigenous

lands and locating claims to sovereignty, autonomy and land ownership at the heart of urban planning.[237]

Addressing epistemic injustice also relates to building recognition for local and traditional forms of knowledge. In Finland, local knowledge has contributed to protecting ecosystems in urban planning processes, especially in preserving nature of importance to residents.[238] Traditional knowledge has played a role in biodiversity preservation in communities in northeastern India, for instance, by maintaining community gardens.[239] In Bucharest, Romania, a participatory process compiled residents' experiences and needs to develop bicycle infrastructure aligned with local preferences.[240]

Taken together, indigenous knowledge, local knowledge and traditional knowledge provide alternatives to expert-led, technical-scientific planning, more recently captured by the concept of "subaltern knowledge."[241] Subaltern knowledge consists of situated, place-based forms of knowing excluded from dominant knowledge production and planning processes. Subaltern knowledge can play a crucial role in environmental planning, for example, urban climate adaptation, especially in producing socially just and responsive plans to the needs of diverse communities.[242]

Box 5.6: Post-COVID-19 resilience in informal settlements

A partnership between Cities Alliance and Shack/Slum Dwellers International (SDI) established to support informal communities to build resilience in the context of the COVID-19 pandemic provides insights on how to align recovery programmes with the priorities of the urban poor. First, the provision of sanitation is essential in communities that lack access to basic washing facilities. Projects that provide such services can play a role in aligning measures to prevent virus transmission with ensuring long-term access. Second, by strengthening safety nets, communities can reduce vulnerability to multiple kinds of shocks. For example, savings groups can address collective concerns with pooled resources. Third, communities can play a leading role in collecting data and raising awareness. Thus, they can draw attention to urgent needs, formulate collective priorities, build channels of communication and negotiate capacity vis-à-vis government authorities or donors.

Source: SDI, 2021.

Urban initiatives to address epistemic injustice support the revaluation of identities and perspectives and the creation of rights for socially or politically excluded people (e.g. based on age, ethnicity, race, migratory status, sexuality, or gender).[243] One relatively well-known example is the lack of recognition of waste pickers,[244] of which organizations like WIEGO work with such communities to build legitimacy and respect for their work.[245]

Gender-responsive planning includes strategies to address gendered power relations and make women's perspectives central to urban planning.[246] For example, projects to rediscover and preserve cultural heritage help revalue histories and cultural identities that have been marginalized in a city. Cultural heritage protection can easily be co-opted by global narratives not aligned with local concerns[247] or even reinforce inequalities and oppression.[248] Methods of "counter-mapping" and artistic production can provide alternative means to redefine the feminist city.[249]

5.5.2. Processes that include diverse perspectives in environmental decision-making

A green, sustainable urban future requires delivering environmental benefits across urban areas to reach every segment of the urban population, especially those who are most disadvantaged. Prioritizing the needs of the most vulnerable means creating opportunities within local planning processes to represent their views, a requirement already reflected in the 2030 Agenda for Sustainable Development. Planning needs to be approached as a collaborative process capable of bringing together diverse views and perspectives.[250] A variety of formal organizational arrangements enable public participation in urban decision-making (Table 5.7). Many of these tools are regularly used to incorporate participatory designs into urban planning processes.

The popularization of mobile applications has increased the use of participatory tools in urban planning, including as a means to collect environmental information, create local networks and facilitate public dialogues.[251] Some models of public involvement and participation are also available in electronic formats, which in some contexts may increase opportunities for access. In China, for instance, such technologies have unleashed a stronger public voice on environmental governance and sustainability issues relating to urban areas.[252] However, such advantages are context-dependent and online communication may be most effective in combination with face-to-face interaction.[253]

Table 5.7: Institutions and methods that facilitate participation in urban planning and management

Method	Definition and benefits	Examples
Citizen assemblies	Decision-making bodies composed of lay citizens tasked with providing a recommendation on specific policy issues. Citizen assemblies are used in urban planning to engage ordinary residents and create deliberation.	The Grandview-Woodland Citizens' Assembly in Vancouver, Canada, involved citizens in a broad range of urban planning decisions showing that an assembly can be a cost-effective way to realize citizen participation. A citizen food assembly organized in York, UK, functioned as a platform for debate and drew attention to food insecurity.
Citizen panels or citizen juries	Created by a random selection of citizens to provide feedback on policy options or, in the case of juries, provided with information and expert input to make a recommendation on a policy issue	In Spain, citizen juries have increased citizen engagement in social problems; however, they represent limited participation in decision-making systems overall, and their impact on policy may be limited.
Community councils	Decision-making body through which residents can influence neighbourhood decisions. They exist in multiple forms (neighbourhood associations, community enterprises, religious congregations), which may be grassroots-led or supported by local authorities. Community councils can provide access to political processes for low-income groups, but in operating outside of formal democratic institutions, they may also be co-opted by dominant local interests.	In East Jerusalem, community groups perform many social functions, including service provision (e.g. education and culture), community organization, and political representation.
Participatory budgeting	An approach to involve citizens in budget allocation that aims to increase citizen involvement, enhance the accountability of decisions related to local finance, and align planning processes with local needs. It can be used in relation to urban environmental planning.	Experiences from Porto Alegre and Belo Horizonte, Brazil, suggest that participatory budgeting can increase access of previously excluded groups to decision-making, even though the poorest citizens remain excluded. In Porto Alegre, participatory budgeting may have brought environmental benefits by channelling financial resources towards sanitation and wastewater management, public transport, waste collection and green space. Participatory budgeting in Polish cities functioned as a source of creativity and innovation, with potential benefits for environmental management. Participatory budgeting processes in Medellín, Colombia, empowered women, including through enhanced leadership skills and awareness of the political system. In cities in the US, participatory budgeting has played a role in providing access to "traditionally marginalized residents," including "non-citizens, seniors, people of colour, and youth" (at the same time, the time-consuming character of these processes is identified as a drawback).
Participatory planning	Participatory elements are central to broader urban planning processes, such as master plans or zoning regulations. Participatory planning is also a strategy to address urgent issues in deprived neighbourhoods or informal settlements.	Experiences from São Paulo have shown that participation in master planning and zoning is one way for groups to articulate priorities in planning processes. However, such participation favoured affluent citizens, and they are not guaranteed to deliver socially just outcomes. In Kenya, participatory planning in informal settlements has been used to advance upgrading schemes and identify residents' priorities. However, in Egypt, participatory exercises in informal settlements have struggled to address underlying drivers of marginalization, such as land ownership and tenure, housing markets, and financing structures.
Consultative processes	In urban planning, consultations can take a range of formats, such as surveys, focus groups, public meetings, or citizen dialogues. These processes can be implemented with varying numbers of participants, in comprehensive urban planning processes or sector-specific issues, and city-wide processes or neighbourhoods.	Participatory methods in Malaysia's urban planning processes include public hearings, citizen forums, community or neighbourhood meetings, citizen surveys, focus groups, and online public outreach. Some methods are more effective in reaching larger numbers of citizens (e.g. citizen surveys). In contrast, other methods may be less representative but more effective in terms of generating deliberation to address complex questions (e.g. public hearings or focus groups).

Note: Participatory mechanisms extend the definition of citizenship to everyone in a city regardless of their citizenship status, to avoid excluding vital participants such as migrants and refugees

Source: Lacelle-Webster and Warren, 2021; Beauvais, 2018; Doherty et al, 2020; Font and Blanco, 2007; Avn et al, 2021; Souza, 2001; Calisto Friant, 2019; Bernaciak et al, 2017; Park et al, 2018; Hajdarowicz, 2018; Gilman, 2016; Nasca et al, 2019; Caldeira and Holston, 2015; Majale, 2008; Khalifa, 2015; Ismail and Said, 2015.

Box 5.7. Participatory approaches to future visioning and scenario planning

There is a growing interest in participatory visioning, forecasting and scenario planning methods, including approaches that build on arts and creative exercises. This interest emerges from the need to radically rethink cities and urban futures to respond to social and ecological crises.

Participatory scenario planning represents one approach to reimagine urban futures collectively. A scenario is "a coherent, internally consistent, and plausible description of a potential future trajectory of a system."[254] Scenario planning assumes that the future is uncertain; therefore, planning must consider multiple development trajectories with differential impacts on diverse social groups.[255] Scenario planning combines quantitative methods (modelling, forecasting, analyses of large datasets) with qualitative strategies to draw on experiential knowledge and imagine different futures.[256] The technique is used in relation to natural resource management (e.g. forests, wetlands, coral reefs), but also in the context of urban planning to address complex, long-term socio-ecological issues, incorporate multiple knowledges and build shared understandings (examples of applications in urban or peri-urban planning include cases in Germany, Kenya, South Africa, and the US).[257]

While the technical skills involved in forecasting and modelling can significantly influence professional stakeholders, the objective is to engage diverse publics and interests.[258] Public participation sessions, community workshops, and groups discussions are often used throughout the process to ensure that various preferences are embedded in all stages of scenarios planning, employing tools such as drawing, mental models, maps and creating storylines.[259] A key outcome can be to create dialogue about the assumptions and normative principles that underpin data-heavy modelling and projections. The exercise invites dialogue and reflection among stakeholders with different concerns and ideological entry points (e.g. scientists and activists).[260]

At the same time, achieving participation that is both deep (in-depth involvement in scenario creation) and wide (participation of a large, representative segment of an urban population) is often challenging.[261] A comparative analysis of 23 participatory scenario planning processes showed that the average number of participants was around 50 (rarely above 90), there was a lack of diversity of participants, uneven power relations prevented participation on an equal basis, and the impact on policy-making was unclear (monitoring and evaluation were often missing).[262]

There is also a new toolbox of collective visualization approaches available in urban planning, for example, through maps,[263] gaming[264] or public participation GIS tools (for public involvement in spatial planning).[265] However, it is not clear whether such collective visioning exercises necessarily lead to just and green cities. Creative engagement methods encounter similar forms of challenges with participation as conventional participatory tools. They may, for example, focus on narrowly defined goals or preclude in-depth engagement with the lives of urban residents.[266]

5.5.3. Foregrounding collaborative forms of urban governance

Collaborative modes of urban governance are today commonplace in cities around the world. Co-production represents approaches to reimagine urban decision-making from shared ownership in service delivery and joint knowledge production in planning. In the context of service delivery, co-production reflects the logic that municipal services are more effective and just when both public actors and citizen groups are involved.[267] For example, in the delivery of water services in Lilongwe, Malawi, the co-production of services by a public utility and civil society groups addressed inefficiencies in delivery by the state and built social capital among communities.[268]

Co-production responds to the complexity of socio-environmental challenges, which always involve multiple problem frames and possible solutions. Co-production is one way to bring together stakeholders, forms of knowledge, and perspectives in response to this complexity.[269] Also, it represents an opportunity for social movements to shape the terms and conditions of planning.[270] Co-production as a form of joint knowledge production in decision-making can deliver various outcomes, such as local capacity building, drawing attention to environmental injustice and

increasing public communication and transparency.[271] An example of co-production in urban environmental planning is the formulation of the Barcelona climate plan, where co-production opened up the use of new digital platforms to involve citizens, but also raised practical challenges (e.g. with regards to the timing of citizen input, unequal knowledge of participants, and confusion about the meaning of co-production).[272]

Partnership-based approaches bring different social groups (authorities on multiple government levels, businesses, NGOs, community associations) into urban governance. Urban partnerships exist in a range of organizational forms, including more or less formal arrangements, such as contractual arrangements between public and private actors for infrastructure and service delivery (i.e., public-private partnerships, policy coalitions, advisory boards and panels, jointly managed programmes and international networks.[273] Partnerships represent a governance strategy that draws on the strengths of different social groups, including capacities for innovation and investment of the private sector and abilities of community engagement and responsiveness of social issues of civil society.

Urban decision-making can also operate through different forms of synergies with activist movements. The inclusion of multiple perspectives in environmental decision-making occurs through collaboration and contestation and conflict, even agonism and strife.[274] Activist groups play a crucial role in urban environmental politics, including introducing new issues into decision-making agendas, drawing attention to existing forms of injustice, and participating in neighbourhood projects— as long illustrated by environmental justice movements.[275] The recent wave of global youth protests in climate politics such as Fridays for Future, Extinction Rebellion and the Sunrise Movement highlights the importance of demonstrations in environmental politics.

The engagement of grassroots organizations, community groups and international environmental movements played a crucial role in adopting declarations of climate emergency by local authorities around the world.[276] The rising awareness of the complex interconnections between multiple forms of social and environmental injustice, such as the links between racism, environmental justice and state violence,[277] creates a renewed sense of urgency for activist groups and social movements in urban environmental decision-making processes.

5.6. Building Global Urban Partnerships

The events of the last two years, raising concerns about climate change and the need to deal with the COVID-19 pandemic, have highlighted the need for a global partnership for sustainable development. This is a moment like no other to facilitate cooperation and global solidarities.[278] Building partnerships requires an enabling environment capable of sustaining long-term initiatives that recognize every actor, from youth activists to private-sector corporations, as part of the solution.[279]

Climate politics is dominated by multilateralism, as the UNFCCC orchestrate efforts via voluntary agreements and nationally determined contributions.[280] However, the impact of these efforts requires examining action on the ground and gaps between voluntary commitments and emission reductions needed to achieve the goals of the Paris Agreement persist.[281] Subnational actors not only can provide additional emission reductions to bridge this gap[282] but also can influence global partnerships and advancing global development agendas. [283]

Transnational municipal networks (TMNs) facilitate the cooperation on climate change between local governments and other subnational institutions, including regions, and non-state actors that can stir up climate action at the local level.[284] These networks have harnessed cities capacities to create a new scene of global environmental governance. [285] City networks cast local governments as mediators between global concerns and place-based solutions.[286]

TNMs are most often voluntary and non-hierarchical organizations.[287] While there is a variety of models of TMNs, multinational membership is a shared characteristic.[288] Membership of transnational municipal networks is more common in Europe and North America, but many have global reach.[289] TMNs support cities to create and implement policy and planning, practices and voluntary standards that support emission reductions and address vulnerabilities.[290] Gaining influence in international arenas is a key motivation for cities to join TNMs.[291]

City networks cast local governments as mediators between global concerns and place-based solutions

Box 5.8: Transnational municipal networks in global environmental governance

The International Council for Local Environmental Initiatives (ICLEI) is a pioneering TMN. It was created after hundreds of local governments gathered at the Congress of Local Governments to a Sustainable Future organized by the United Nations Environmental Programme (UNEP) in New York, in 1989 with 200 local governments from 43 countries. In its inception, ICLEI's main objective was to support local governments to transform effectively towards a greener economy.[292]

With currently over 1,750 local and regional governments in more than 100 countries, the organization helped cities embark on a pathway towards low-emission, nature-based, resilient and circular development. ICLEI's first programs emphasized participatory governance and sustainable local development planning. The Cities for Climate Protection (CCP) campaign, promoted by ICLEI, was the first to support cities in planning climate action to reduce greenhouse gas (GHG) emissions, improve air quality and increase sustainability and habitability. Over the past decade, UN-Habitat and ICLEI have supported local governments as they develop comprehensive urban low-emission development strategies (Urban-LEDS) and climate action plans.

Another bottom up TNM is the C40 Cities Climate Leadership Group (C40), formed in 2005 when the London Mayor Ken Livingstone brought together representatives of 18 megacities to cooperate to reduce greenhouse gas emissions. The group has grown currently including near 100 megacities in every region. C40 has increasingly focused on establishing concrete, measurable goals but its members are also increasingly concerned about the potential of coupling emission reductions with ancillary benefits for resilience and prosperity.

The European Union's Covenant of Mayors for Climate and Energy (EU CoM) was launched in 2008 with the European Commission's support.[293] As of January 2021, EU CoM has more than 10,600 signatories, mainly from the EU, as well as nearby countries like Morocco and Turkey. The Covenant of Mayors also appears as a key actor in the Urban Agenda for the EU, launched with the Pact of Amsterdam. Other top-down networks have emerged from the cooperation between multiple organizations at different levels. For example, in 2014, the United Nations Secretary-General Ban Ki-Moon and its Special Envoy on Cities and Climate Change, Michael R. Bloomberg, in cooperation with C40 and ICLEI, launched the Compact of Mayors. The Global Covenant of Mayors for Climate and Energy (GCoM) emerged with the combination of efforts in the Compact of Mayors and the EU Covenant of Mayors in 2016, becoming the largest initiative of this kind, with more than 10,500 cities and local governments from 138 countries as of 2021.

Source: Castán Broto et al, 2022; Urban LEDs Project (https://urban-leds.org/)

5.7. Concluding Remarks and Lessons for Policy

This chapter engages with the potential to deliver green urban futures. It highlights some aspects of the current state of climate action:

- First, delivering green urban futures is a massive challenge of global proportions, and so far, our collective impact on global average temperatures has been limited. A more significant effort is needed to turn around the unsustainable pathways that contemporary cities and urban areas follow.

- Second, there is mounting evidence about future scenarios' development and how future thinking can inform urban planning. A key lesson is that scenario planning requires input from multiple actors and that forecasting techniques alone are not sufficient to deliver an urban transition to sustainability.

- Third, in the post-pandemic context, there are increasing fears that we are losing the window of opportunity to catalyze a green urban transition through the deployment of recovery funds.

- Four, inclusive planning processes must recognize multiple forms of knowledge valuable to planning and recognize the need to deliver equity and justice. In the case of informal settlement dwellers and impoverished populations, this means recognizing all urban dwellers not as passive victims of an urbanization process but

as active makers of urban futures that must be given a range of arenas to make their voice heard.

The following policy lessons may contribute to sustainable urban futures:

- Invest in participatory methods for scenario planning and combine participatory planning techniques with forecasting techniques.
- Prioritize inclusion and the needs of the most vulnerable in the delivery of green urban futures.
- Prepare to learn from both transnational experiences of climate and biodiversity action and place-based initiatives.
- Build capacities to enable change at scale.
- Experiences in energy management, transport, risk management and nature-based solutions demonstrate the potential of people-oriented forms of planning.

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