Chapter 1:

Cities as Hubs for Climate Action

Quick facts

1. Urbanization continues to be a major source of greenhouse gas emissions, with urban emissions per capita lower than national averages.
2. Irrespective of their levels of urbanization, countries can plan and commit to ambitious climate action targets.
3. Countries are not condemned to face rising emissions while urbanizing: net zero or low-carbon pathways can be achieved through appropriate climate-responsive planning choices.
4. Countries that have a higher share of informal housing and employment are more vulnerable to climate change.

Policy points

1. Climate action, as currently implemented in urban areas, does not reflect the urgency of the threat posed by climate change.
2. People must be at the centre of any meaningful climate action in cities and human settlements.
3. Cities are at the forefront of addressing the challenge of climate change, both in terms of direct mitigation and adaptation efforts and resilience building.
4. Aligning climate change adaptation with poverty reduction and disaster risk reduction through community-led settlement upgrading can help build resilience to climate shocks.

The theme of this volume of the World Cities Report is largely driven by the severity of the threat posed by climate change and its complex relationship with urbanization. This is hardly the first time UN-Habitat has explored the subject: for instance, the Global Report on Human Settlements 2011: Cities and Climate Change engaged with the very same issue.[1] However, the failure in the intervening years of the world's governments to respond adequately to the scale of the challenge means that, if anything, it has even greater relevance today. Today, it is widely recognized that climate change potentially poses an existential threat to humanity, with urban areas particularly vulnerable to rising sea levels, increased temperatures and other effects. In this regard, given the high level of emissions they produce, cities have been framed as both victims of climate change and its most egregious perpetrators.

Today, it is widely recognized that climate change potentially poses an existential threat to humanity

Nevertheless, while this is undoubtedly part of the picture, it is also the case that cities could play—and indeed are already playing—a key role in addressing these challenges. This resonates with the view that "cities are where the climate battle will largely be won or lost."[2] While urban areas concentrate activities that drive greenhouse gas (GHG) emissions, they can also serve as sites for effective and inclusive climate action. In this spirit, four key issues underpin the framing of the World Cities Report 2024:

- the *urgency of action*, given the devastating impacts of climate change as witnessed in different parts of the world: for a variety of reasons, from limited political authority to lack of access to adequate financing, much of the potential of cities as leaders in climate action is still not being realized, despite the serious threat climate change poses.

- the *reinvigorated role of cities*, given their unique characteristics: notwithstanding the challenges listed above, there is increasing recognition at a national and international level of the unique synergies that urban areas offer. This is demonstrated by the experimentation and innovation that cities themselves—including informal settlements—are contributing to adaptation and mitigation efforts.

- the *people-centred nature of climate action:* while technology and finance are both important elements of climate action, residents and communities are indispensable to any meaningful effort to address the root drivers and impacts of climate change. The increasing awareness that resilience at the local level is as much social as environmental could radically reconfigure the dynamics of traditional top-down responses to climate change.

- the *implementation of transformative, inclusive climate action* that cities and human settlements can take: rather than viewing climate change as a discrete problem, separate to the other challenges that cities face, some of the most promising approaches are now integrating climate-resilient planning and investment into wider strategies that also address poverty, inequality and social exclusion. This offers an inspiring alternative vision to the disproportionate impacts that climate change has had until now on the urban poor: the possibility that climate action could not only alleviate these threats, but also lead to a more just future for all.

1.1 The Urgency of Climate Action

The global response to the threat of climate change has witnessed the adoption of landmark agreements, including the Paris Agreement on Climate Change, the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals (SDGs) and the New Urban Agenda (NUA). In the same vein, the United Nations Framework Convention on Climate Change (UNFCCC) has convened the Conference of the Parties to assess progress in addressing climate change. The consistent theme emerging from all these is the existential global threat posed by climate change, confirming its severity and the need for effective action. Over 3.3 billion people—more than 40 per cent of the global population—live in regions that are highly vulnerable to climate change.[3] The climate crisis is seen as "the biggest threat to security that modern humans have ever faced".[4] It is, together with pollution and biodiversity loss, a central part of the "triple planetary crisis".[5] The gravity of climate change is such that it has the potential to trigger "civilization collapse".[6]

The year 2023 has been confirmed as the hottest in human history, with scorching temperatures witnessed in different parts of the world. The global temperature for 2023 was about 1.48°C above the pre-industrial 1850-1900 baseline, with the nine years between 2015 and 2023 being the hottest on record.[7] This prompted the Secretary General of the United Nations to state that "the era of global warming has ended, the era of global boiling has arrived".[8] Heatwaves—frequent, longer and more intense—will be the "new normal" for decades to come.[9]

The year 2023 has been confirmed as the hottest in human history, with scorching temperatures witnessed in different parts of the world

All these warnings, which are supported by empirical evidence, show that the world is off track in meeting SDG 13 on climate action and is "edging ever closer" to the 1.5°C threshold, with the potential of it being exceeded for a protracted period.[10] The more the world continues to fall behind in meeting the goals of the Paris Agreement, the greater will be the impacts of climate change as a threat multiplier, hampering development and economic progress.[11] This in turn will exacerbate urban challenges and make it even harder to achieve the SDGs.

The global rise in temperatures continues unabated, leading to a recurring and escalating trend of extreme weather events—heatwaves, hurricanes, storms, floods, fires and other hazards—posing severe threats to lives, livelihoods and well-being, especially among marginalized populations. The effects of climate change are particularly dire in developing regions, particularly Small Island Developing States (SIDS) highly exposed to the

destructive effects of climate-related disasters.[12] The vulnerabilities of these communities mean that routine weather events can become full-blown humanitarian crises, with their attendant impacts: loss of lives, property destruction and displacement.

Heatwaves—frequent, longer and more intense—will be the "new normal" for decades to come

The past few decades have witnessed a remarkable rise in the number of climate-related natural disasters, from just 58 in 1970 to 381 in 2021—a more than six-fold increase in just over 50 years.[13] There has also been a doubling in the annual rise in global sea-levels from 2.27 mm per year between 1993 and 2002, to 4.62 mm per year between 2013 and 2022.[14] This is expected to continue despite efforts to limit global warming to 1.5°C, with major implications in particular for the estimated 900 million people—"one out of every ten people on Earth"—living in low-elevation coastal zones.[15]

The impacts of climate change are intersecting with and exacerbating other challenges—poverty, inequality, conflicts, displacement, water scarcity, food security and loss of livelihoods—in the process reversing decades of development gains. The economic costs associated with climate change are staggering: having doubled seven-fold since the 1970s, they now account for hundreds of billions of dollars in damage every year.[16] It is estimated that the global economy could lose up to 18 per cent of GDP by 2050 if no mitigating actions are taken.[17] In the case of the built environment, global average annual losses arising from disasters could reach US$415 billion by 2030.[18] By 2050, according to some projections. extreme weather events associated with climate change could erase 9 per cent (US$25 trillion) from the value of the world's housing.[19]

1.1.1 Contradictions and limitations of climate action to date

Despite the threat posed by climate change, global efforts at mitigation and adaptation are not keeping pace with the increasing risks: even if current pledges are kept to, the planet will still be on track for a 2.4-2.6°C temperature rise by the end of the century.[20] To limit temperature rise to no more than 1.5°C, as called for in the Paris Agreement, global emissions have to decline by 45 per cent by 2030 compared to 2010 levels and achieve net zero by 2050.[21] At present, however, projections suggest that even if the national climate plans for all 195 countries that are signatories to the Paris Agreement are implemented, emissions are still likely to increase by 8.8 per cent by 2030.[22]

Despite the threat posed by climate change, global efforts at mitigation and adaptation are not keeping pace with the increasing risks

Although most countries have agreed to strengthen their climate action plans, lower their emissions and even set net zero targets, there is still a significant gap between rhetoric and action. Bold steps towards reducing emissions are yet to be taken. By contrast, policy support to produce fossil fuels remains strong. A recent assessment of national energy plans and projections shows that "the world's governments still plan to produce more than double the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C".[23] A further sign of misaligned commitments and actions can be seen in the fact that many major fossil fuel-producing countries are planning to scale up production for years or decades to come, resulting in near-term increases in the global production of coal (until 2030) and long-term increases (until at least 2050) in oil and gas.[24] In line with this trend, fossil fuel subsidies reached a record US$7 trillion in 2022 in the wake of the economic recovery from the COVID-19 pandemic and Russia-Ukraine conflict.[25] In particular, the conflict placed energy transition at a crossroads and provoked a global "gold rush" for oil, gas and even coal.[26]

Although most countries have agreed to strengthen their climate action plans, lower their emissions and even set net zero targets, there is still a significant gap between rhetoric and action

These investments have the potential to lock in new GHG emissions for decades and are essentially competing with efforts to accelerate the energy transition and close the 2030 emission gap.[27] However, the International Energy Agency (IEA) notes that the global energy crisis triggered by the Russia-Ukraine war carries the potential to hasten the transition to "a cleaner and more secure energy system."[28] New policies in major energy markets such as the US, EU, China, Japan, Republic of Korea, and India are likely to push annual clean energy investment to more than US$2 trillion by 2030, up from US$1.3 trillion in 2021.[29] A review of the long-term low-emission development strategies from 62 parties to the Paris Agreement (representing 83 per cent of the world's GDP, 47 per cent of the global population and around 69 per cent of total energy consumption in 2019) indicates that the world is starting to aim for net zero emissions. If fully and timely implemented, these countries' GHG emissions could be 68 per cent lower in 2050 than in 2019.[30]

While this represents a bright spot, there is lingering uncertainty regarding many net zero targets. Questions remain as to the wisdom of postponing into the future much critical action that needs to be taken now. Nevertheless, amidst the lack of ambition characterizing climate action, there is still some optimism, albeit within a decreasing window of opportunity. A decisive milestone for climate action took place at the 2023 United Nations Climate Change Conference (COP28), when almost 200 countries agreed to "transition away" from coal, oil and gas, a move hailed as the "beginning of the end" of fossil fuel dependence.[31] Notwithstanding, there is a sense of disappointment in many quarters that the COP28 agreement was not more far-reaching in calling for the explicit commitment to phase out fossil fuels. It remains to be seen how this agreement will be translated into action and what role cities can play in this process: in the meantime, it is likely that fossil fuels will continue to dominate the energy mix for some time to come.

Box 1.1: Adaptation and mitigation: The two strands of climate action

Throughout this report, the text refers to two important areas of climate action: mitigation and adaptation. The two are distinct, though often interlinked, activities that work together to slow or even reverse climate change while alleviating its effects on communities. *Mitigation* relates to "any action taken by governments, businesses, or people to reduce or prevent greenhouse gas emissions, or to enhance carbon sinks that remove these gases from the atmosphere".[32] Reducing GHG emissions in cities can be achieved by adopting renewable energy, low-carbon or zero-carbon multimodal transport, sustainable land use, building construction and industrial processes, and models of production and consumption that are more sustainable, including behavioural and lifestyle changes. Carbon sinks can be enhanced through NbS—planning of trees, restoring forests, wetlands, and marshlands, maintaining soil health, and protecting terrestrial and marine ecosystems.[33]

Adaptation to climate change, on the other hand, relates to "actions that help reduce vulnerability to the current or expected impacts of climate change like weather extremes and hazards, sea-level rise, biodiversity loss, or food and water insecurity".[34] To be effective, adaptation to climate change needs to occur at the local level. Consequently, communities, cities individuals, groups of individuals and a wide range of institutions need to be empowered to play a pivotal role.[35] Adaptation measures include building climate-resilient infrastructure (Chapter 6), developing stronger protection against extreme weather events, developing early warning systems and disaster preparedness, resilience planning (Chapter 5), better management of land, insurance schemes specifically designed to address climate-related threats, addressing the specific needs of vulnerable groups through sustainable sources of livelihood, food and water security, adequate health care and social protection programmes (Chapter 4)—all of which help build resilience.

Successful adaptation leads to resilience, which is the outcome of governments, the private sector, civil society organizations, households and individuals with strong adaptive capacity.[36] While adaptation is implemented at the local level, it needs to be driven at the national and international levels, largely due to the huge financial outlay (Chapter 9) and capacity required (Chapter 7), which is often beyond the scope of cities especially in developing countries.

Flooded parts of Chittagong City, Bangladesh. There has been an increase in unpredictable rainfall that leaves roads and homes flooded as a result of climate change.

1.2 Cities at the Forefront of Reinvigorated Climate Action

Until recently, cities were perceived as part of the problem: namely as exponents of sprawl, informal settlements and climate inaction. This narrative is changing, partly due to the sustained work of the IPCC on cities and human settlements.[37] Indeed, by their very nature, cities should be at the forefront of climate action. Emissions per capita at the urban level are often lower than the national average, particularly in well-planned and managed settings, meaning that urban areas have the potential to be more carbon-efficient.[38] While urbanization has contributed to an overall decline in global green spaces,[39] data covering the period between 1990 and 2014 show that green spaces within cities have increased[40]—demonstrating that, with the appropriate regulatory and urban planning policies in place, urban areas can play a significant role in regreening the planet.

Although urban areas cover only a tiny fraction of the world's surface, their social, economic, and environmental processes and impacts extend beyond their boundaries, often through the production and consumption patterns that link the world together.[41] Much of the energy and resources that cities use is produced and extracted far outside their administrative borders. Cities also benefit from the ecosystem services that rural areas provide in the reduction of climate hazards and carbon storage.[42] Global or national climate mitigation can therefore not be achieved independently from urban climate mitigation.

The central tenet of cities at the forefront of climate action is that cities, defined simply as dense concentrations of people, businesses and institutions, represent not only places of enhanced and clustered vulnerability to climate change. They are also places where climate action can be leveraged through co-creation and co-benefits can be leveraged; places that enable a wide range of uniquely urban policies to lower emissions; and places which act as centres of buoyant innovation and advocacy. Positioning cities at the forefront of climate action does not negate the role of national and subnational governments, but rather highlights the unique nature of cities.

Positioning cities at the forefront of climate action does not negate the role of national and subnational governments

1.2.1 Cities as places of concentrated climate threat exposure

The concentrated nature of people, businesses, institutions, and infrastructure in urban areas makes them vulnerable to climate shocks.[43] It is estimated that a 2°C increase in global temperature in 2050 will expose 2.7 billion people to moderate or high climate-related risks, with the large majority (between 91 and 98 per cent) situated in Africa and Asia.[44] Climate-related disasters account for 91 per cent of the 7,255 major disasters that occurred between 1998 and 2017.[45] Though felt globally, climate change has a distinctive urban impact, as 64 per cent of the urban population has a high level of exposure to disasters.[46] The urban poor, particularly residents of informal settlements, are disproportionately exposed to extreme weather events on account of their location, poor quality of construction and limited savings.[47]

Many cities, in particular coastal urban areas, are vulnerable to sea level rise and flooding. By 2050, there will be over 800 million residents of coastal cities at risk of at least 0.5 metres of sea level rise and flooding.[48] Besides the risk of coastal inundation, cities are also exposed to rainwater flooding as a result of inadequate drainage and the increasing coverage of concrete, asphalt and other materials that prevent water infiltration. In Odense, Denmark, for instance, it is projected that an increase of just 1 per cent in impervious area could expand its flood-prone area by more than 10 per cent.[49] Other climate change impacts that are context-specific to cities are urban heat islands. By the 2050s, more than 1.6 billion urban residents will be exposed to extreme temperatures of at least 35°C.[50] As with flooding, poor residents tend to be disproportionality exposed to extreme heat and its attendant impacts.[51] Another problem is urban air pollution, which is entwined with climate change, accounted for 6.7 million premature deaths in 2019, making it the world's largest environmental risk factor for disease and premature death.[52]

As with flooding, poor residents tend to be disproportionality exposed to extreme heat and its attendant impacts

1.2.2 Cities as places that foster circularity

Cities are uniquely positioned to pursue urban circularity, which has the potential to generate significant co-benefits, thereby making more efficient use of limited resources. For instance, improved public transport can reduce emissions and enhance resilience, while simultaneously, addressing structural inequality by connecting low-income urban dwellers to better jobs.[53] The proximity of disadvantaged groups to sites that generate negative environmental externalities is potentially a risk, but could present an opportunity for investment in climate action that can be leveraged to address persistent problems such as poverty, inequality and inadequate infrastructure. Nature-based solutions (NbS) to enhance resilience to flooding can also enhance food security, provide public green spaces and yield economic benefits.[54]

An electric bus ferrying passangers in Chandigarh, India © PradeepGaurs/Shutterstock

The proximity of people, activities and mix of uses enable cities to easily share and optimize resources, and close existing energy and waste loops through recycling, reuse and energy recovery.[55] This may manifest in several ways: waste-to-energy plants, greywater recycling, urban regeneration and the retrofitting, refurbishment and renovation of buildings. Resources can be shared in cities across a range of activities, including living (co-housing), working (co-working spaces) and travel (mass transit and vehicle sharing schemes).

By localizing the production and consumption of resources, both positive and negative externalities of resource consumption are also localized.[56] This in turn puts communities in a better position to make informed and sustainable choices that preserve their environment. Such negative externalities not only come from polluting land uses, which are often sited near poor neighbourhoods,[57] but also from how climate adaptation can lead to gentrification and displacement of vulnerable communities.[58] This is further discussed in Chapter 4.

1.2.3 Cities as places of unique mitigation and adaptation opportunities

While climate mitigation involves measures in both urban and rural contexts, one distinctly urban mitigation pathway enabled by the concentration of people and land uses that cities bring is the compact public transport nexus.[59] Emissions from the transport sector represent the fastest-growing source of GHG emissions[60] and tend to be higher in low-density urban areas without effective public transport networks.[61] Households in high-density cities, on the other hand, are likely to have lower emissions.[62] Effective public transport and policies such as congestion pricing schemes[63] enable residents to live car-free, potentially reducing their individual emissions by as much as 2.4 tCO_2e annually.[64]

The fight against climate change can only be won when the mitigation, adaptation and resilience agendas are initiated based on specific contextual needs

While public transit is a key mitigation measure in 47 per cent of NDCs,[65] its global take-up has been low. Unless this changes, transport may remain a major hurdle in efforts to mitigate global warming.[66] A somewhat similar situation plays out in Europe where municipal action to accelerate a modal shift to public transport generated the most energy savings, but the high upfront costs constitute a barrier to more transformative shifts.[67]

1.2.4 Cities as places of buoyant innovation and advocacy

Cities have fostered innovation, experimentation and advocacy, especially in the face of the challenges posed by climate change.[68] Since the fight against climate change can only be won when the mitigation, adaptation and resilience agendas are initiated based on specific contextual needs,[69] local experimentation is critical. In this regard, the typical urban infrastructure built in the 20th century—typically characterized as rigid, large, centralized, efficiency-oriented and mechanized[70]—can be bypassed or leapfrogged in developing cities in favour of nimbler, decentralized and resilient infrastructure (as shown in Chapter 6).

Cities and local governments are well-placed to foster experimentation and promote "grassroots innovation".[71] Indeed, they are already at the forefront of global advocacy on climate action: the climate commitments of many cities are often more ambitious than those of their national governments.[72] For instance, an analysis of the GHG emission targets of approximately 6,000 subnational governments and 2,000 companies suggests that by 2030 they could contribute 1.5 to 2.2 $GtCO_2e$ more in emission reductions annually beyond that expected from current national government policies.[73] The impacts of other city and local government-based climate initiatives, such as the Cities Race to Zero, are discussed in Chapter 2.

1.2.5 Global development agendas and the need for local implementation

While the international agreements relating to climate change—Sendai Framework for Disaster Risk Reduction, the Paris Agreement on Climate Change, SDGs and the NUA—reflect national commitment, they all require local implementation. It has been suggested that up to 65 per cent of the SDG targets are under threat if local or urban stakeholders are not assigned a clear role in their implementation.[74] This undoubtedly makes cities the loci to transform global agendas into practicable courses of action in diverse local contexts. In this regard, cities are key to realizing SDG 12 as they can undertake climate-sensitive, low-emission planning that promotes sustainable mobility, green infrastructure and the transition to renewable energy.[75]

Given the slow and uneven implementation of the SDGs, together with the "cascading and interlinked crises" facing the world,[76] there is a need to course-correct and accelerate the localization of the 2030 Agenda. Leading the localization of various global agendas does not imply, however, that cities are expected to meet the "action gap" alone. This requires broader action that goes beyond the realm of local governments, civil society and local businesses, and should be complemented with effective multi-level governance strategies (as discussed in Chapter 7). Local governments must be supported by a network of actors operating at different scales, aligning governmental efforts at both the national and the local level, business interests and the efforts of multiple other actors. With these conditions in place, cities all over the world have proved they can be catalysts for positive change: for example, under the umbrella of the Global Covenant of Mayors for Climate and Energy, more than 13,000 cities have made significant commitments to take measurable climate action.[77]

While the international agreements relating to climate change—Sendai Framework for Disaster Risk Reduction, the Paris Agreement on Climate Change, SDGs and the NUA—reflect national commitment, they all require local implementation

1.3 Links between Urbanization and Greenhouse Gas Emissions

It has been established that urban areas generate around three-quarters of GHG emissions. The IPCC in its fifth assessment cycle notes that cities produce "67-76 per cent of energy use" and "71–76 per cent of energy-related CO_2 emissions".[78] These widely cited estimates are based on 2005 estimates by the IEA[79] and studies using Scope 2 data from 2000.[80] A more recent study, drawing on 2015 data, similarly concluded that between 70-80 per cent of global emissions come from urban areas.[81] Using a consumption-based accounting methodology in which emissions are allocated to the persons whose use caused the emissions, the sixth IPCC Report updated the urban emissions to be 62 per cent of the global share in 2015; and between 67-72 per cent of the global share in 2020.[82]

Based on the idea of planetary urbanization,[83] which is premised on the notion that urban development, urban institutions and urban processes extend far beyond city boundaries in ways that are shaping the entire planet, it may then even be argued that all GHG emissions are inextricably linked to urban processes. In this context, it is useful to understand how urban emissions are accounted for. In the Scope 1 measurements, also referred to as area-based accounting, only emissions that directly originate from urban areas are accounted for. Scope 2 emissions also include emissions resulting from imported electricity, while Scope 3 emissions cover emissions that are linked to all other imports, including food, goods and services.

It has been established that urban areas generate around three-quarters of GHG emissions

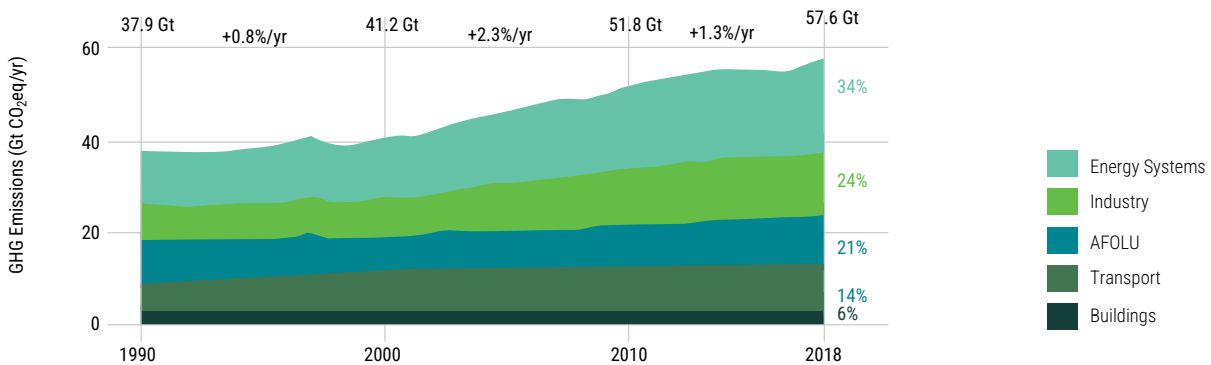
1.3.1 Urbanization and greenhouse gas emissions: Emerging trends

To better understand the role of urban areas, Figure 1.1 provides the global context on GHG emissions disaggregated by sectors based on Scope 1 emissions. Global GHG emissions rose sharply at the rate of 2.3 per cent between 2000 and 2010 and continued on an upward trajectory but at a lower rate of 1.3 per cent annually. Mirroring the global picture, GHG emissions in most regions have been rising, particularly in East Asia. The developed regions of Europe, and to a lesser degree North America, have made the most progress in reducing emissions. This is more evident with CO_2 emissions per capita (Figure 1.2: Average CO_2 emissions per capita (1990-2019), by region2), which declined by 33 per cent between 1990 and 2019.

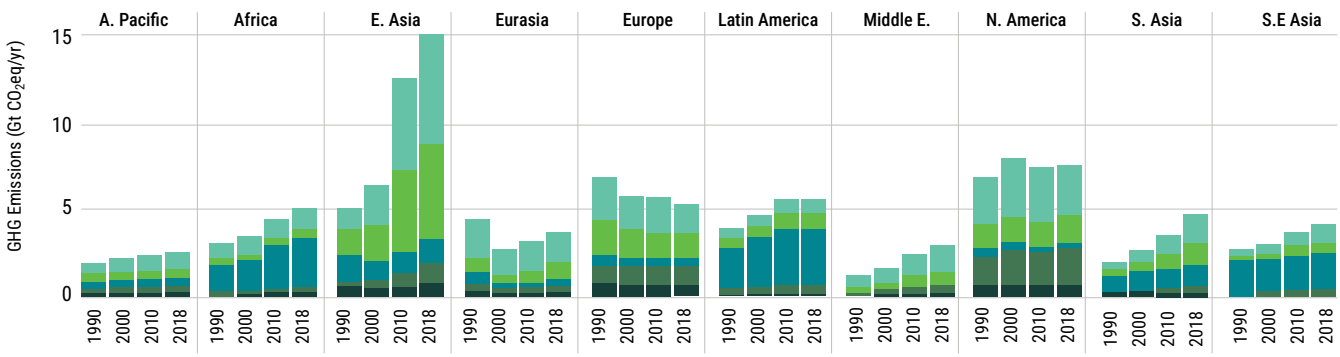
Global GHG emissions rose sharply at the rate of 2.3 per cent between 2000 and 2010 and continued on an upward trajectory but at a lower rate of 1.3 per cent annually

Figure 1.1: GHG emission (Scope 1) trends, 1990-2018, by sector (top) and region (below)

a. Total Global GHG emissions trends



b. Total regional GHG emissions trends



Source: Lamb et al., 2021.

Scope 1 emissions as shown in Figure 1.1: GHG emission (Scope 1) trends, 1990-2018, by sector (top) and region (below)1 can obscure the role of cities and the sectors that are most concentrated in urban areas. For example, the building sector accounts for almost 6 per cent of direct GHG emissions (Scope 1),[84] but when Scope 2 and Scope 3 emissions are included, the building sector accounts for 37 per cent.[85] Figure 1.3: Scopes 1–3 emissions of the five IPCC sectors (1995-2015)3 shows how Scope 2 and 3 emissions compare to Scope 1 emissions for each sector, revealing that when these indirect and embodied emissions are considered, industry dominates global CO_2 emissions.

Figure 1.2: Average CO_2 emissions per capita (1990-2019), by region

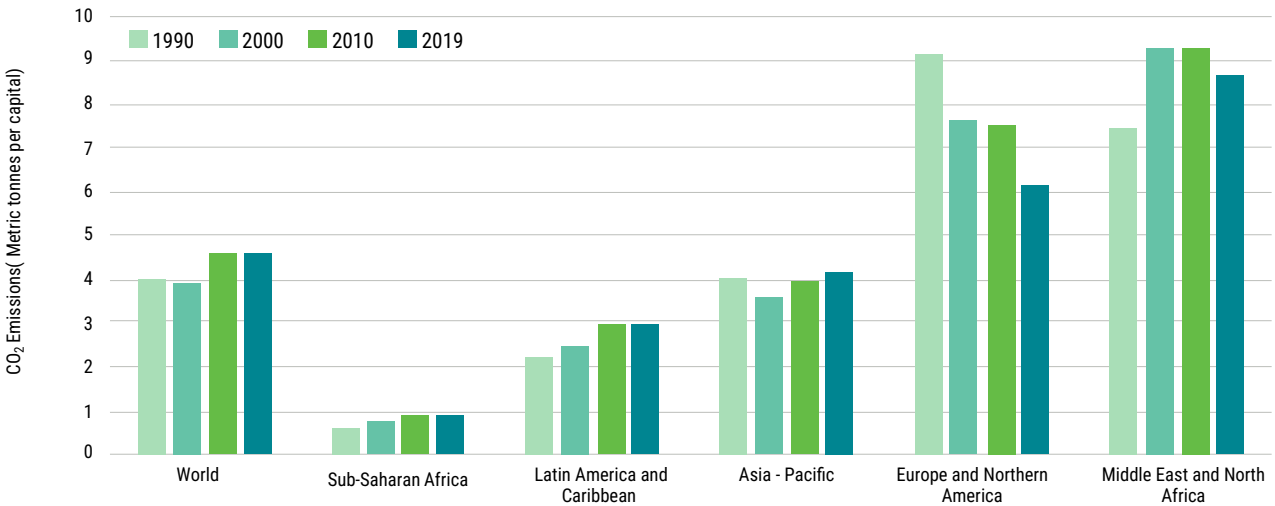
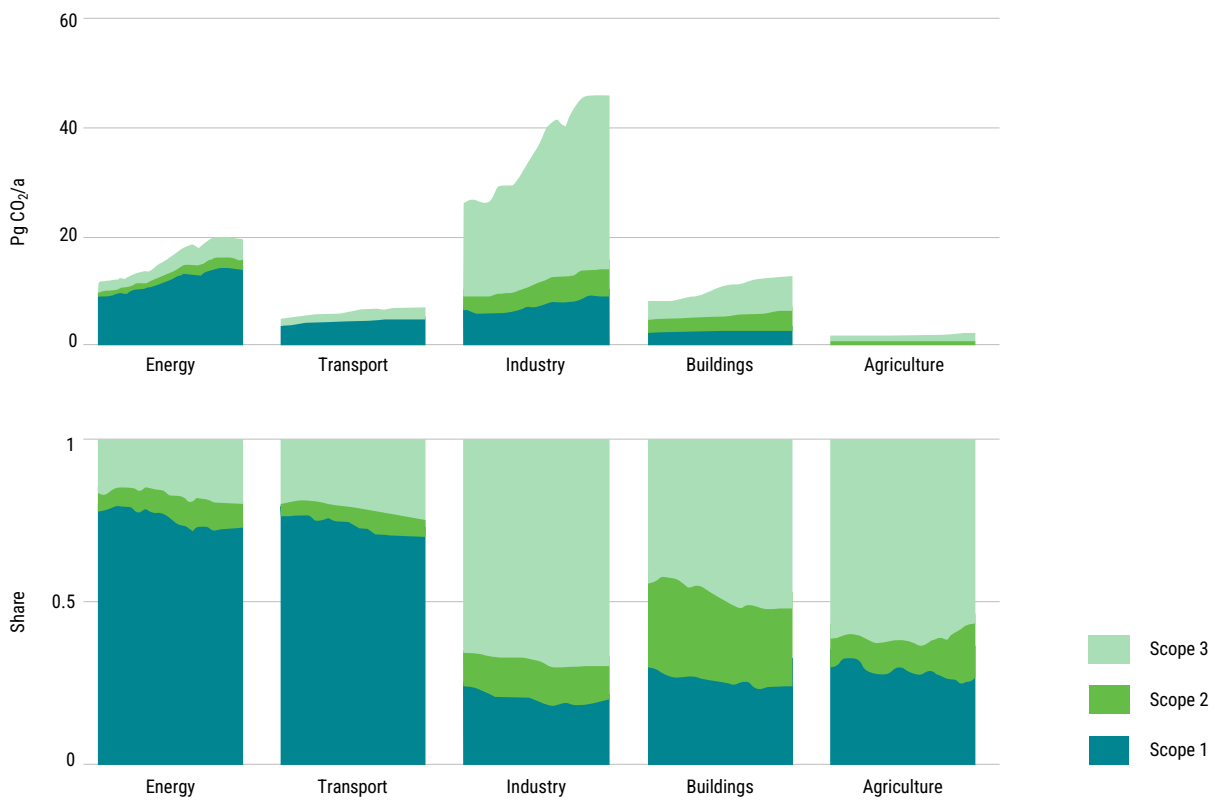


Figure 1.3: Scopes 1–3 emissions of the five IPCC sectors (1995-2015)



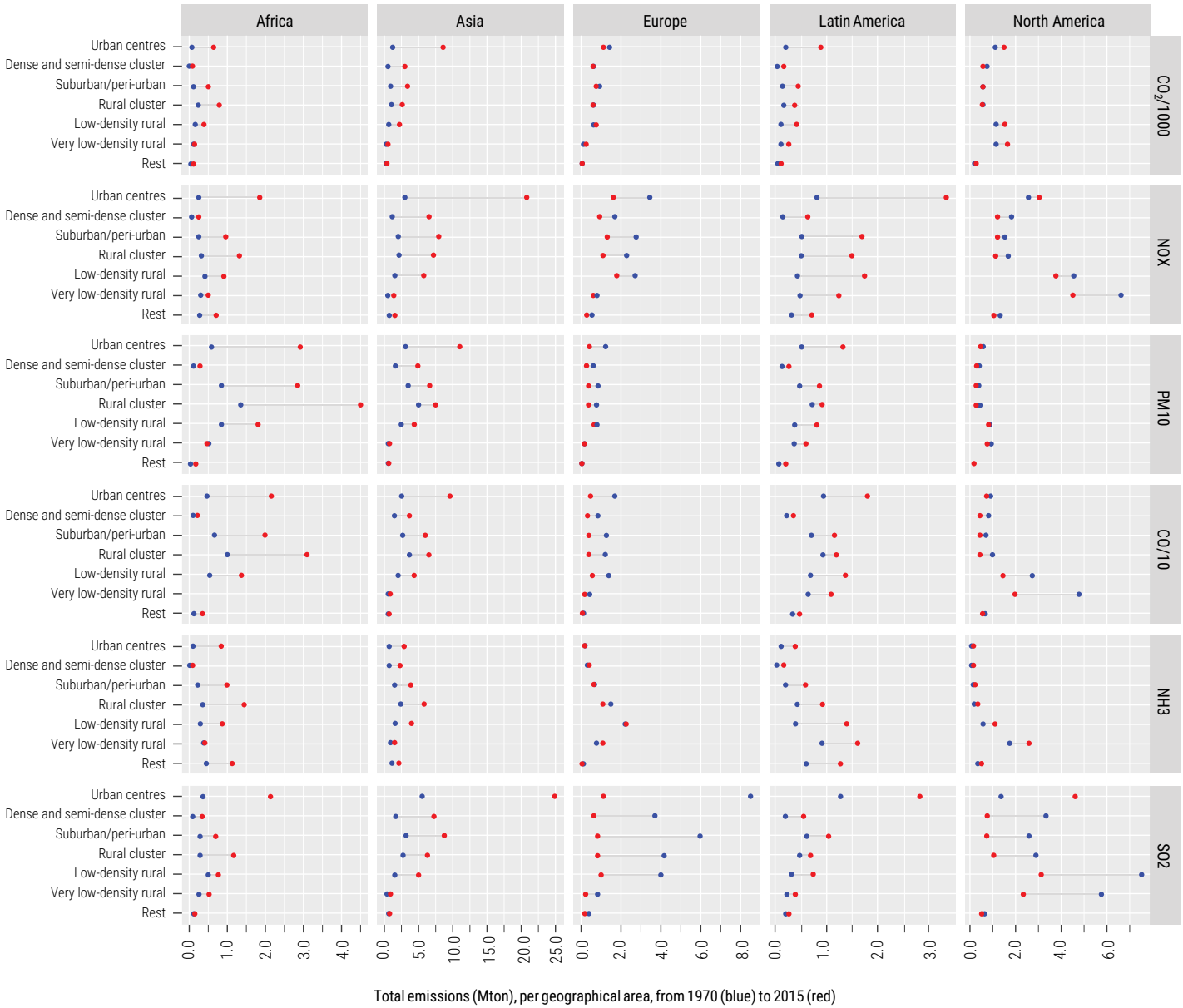
Source: Hertwich & Wood, 2018.

Release of harmful emissions into the atmosphere by industries is a leading cause of global warming. © mykhailo pavlenko/Shutterstock

Emissions and pollutants can be further disaggregated by settlement type within the various regions. This can be done using the recently developed *Degree of Urbanisation*, which is a harmonized definition for urban areas that facilitate global comparison. In this methodology (discussed in greater detail in Chapter 3), *urban centres* are defined as settlements of at least 50,000 inhabitants with greater than 1,500 inhabitants per sq. km; towns and urban clusters are defined as areas with at least 5,000 inhabitants and a density of at least 300 inhabitants per sq. km; and *suburban or peri-urban areas are those urban areas* which fall outside the contiguous area of an urban cluster.

Figure 1.4 shows the change in the range of emissions for these urban categories between 1970 and 2015. This indicates those settlement types where the highest gains in emissions reduction have been achieved. Taking the case of nitrogen oxides (NOx) and CO_2 emissions, high peaks between the two periods are evident in urban centres in Africa, Asia and Latin America, which tend to be associated with vehicular and industrial uses. This is especially the case in Asia where these uses have been significant drivers of emissions. Consequently, policies and practices in both sectors of these regions would need to be overhauled in the quest to achieve net zero emissions. In North America, the high peaks in emissions, especially for sulphur dioxide (SO_2), carbon monoxide (CO) and nitrogen oxides, occur in the low- and very low-density settlements. In Africa, sulphur dioxide and PM10 have high peaks in suburban/peri-urban, rural clusters and low-density rural areas. This in part implies that the biggest gains in emissions reduction for this region can be achieved outside urban centres and other semi-dense clusters. The policies and practices that these trends portend are explored in detail in various chapters of the report.

Figure 1.4 Total emissions (Mton) per geographical area, from 1970 (blue) to 2015 (red)



Source: Crippa et al., 2021.

1.3.2 Urbanization and greenhouse gas emissions

There is general acceptance of the existence of a link between a higher share of people living in urban areas and higher rates of GHG emissions.[86] At the global level, the relationship between the level of urbanization and CO_2 emissions per capita is relatively strong but has been declining consistently since 1990, as indicated by the correlation coefficients for the different periods (Figure 1.5: Correlation between urbanization and CO_2 emissions per capita (1990-2019)5).[87] This positive relationship is consistent with previous studies, which reveal that as urban areas expand and concentrate a greater intensity of people, wealth and consumption, GHG emissions tend to increase.[88] Notwithstanding urbanization's role as a driver of climate change, it is important to recognize that climate change is in turn a driver of urbanization, as deteriorating climatic conditions have been correlated with accelerated urbanization.[89]

At the global level, the relationship between the level of urbanization and CO_2 emissions per capita is relatively strong but has been declining consistently since 1990

Figure 1.5: Correlation between urbanization and CO_2 emissions per capita (1990-2019)

The relationship between the level of urbanization and CO_2 emissions per capita observed in Figure 1.5 is replicated to some extent at the regional level (Table 1.1). While the graphs for each period suggest that on average (as illustrated by the red line), higher urbanization levels continue to be associated with greater emissions of CO_2 per capita, at the same time there has been a marked shift in the strength of the correlation between the two, with the correlation coefficient (r) falling from just over 0.64 in 1990 to almost 0.55 in 2019. This suggests that for a variety of reasons, urbanization has become a less decisive determinant of per capita emissions over time. This is especially the case in developed regions where urbanization has reached its saturation point, and the concentration of people in urban areas might not be the major driver of GHG emissions. In this instance, the higher levels of consumption and production that have accompanied income rises in these countries, in the process driving up emissions, appear to some extent to have been reversed by other factors (such as investments in low-carbon infrastructure, energy efficiency improvements and lifestyle change) that have helped push per capita emissions down. The changing association between urbanization and CO_2 emissions raises a fundamental question: is the process of urbanization becoming more sustainable—or at the very least, less unsustainable—over time?

For a variety of reasons, urbanization has become a less decisive determinant of per capita emissions over time

Table 1.1: Correlation between level of urbanization and CO_2 emissions per capita

Region	Correlation coefficients			
	1990	2000	2010	2019
Asia-Pacific	0.81	0.79	0.69	0.70
Middle East & North Africa	0.61	0.65	0.67	0.65
Sub-Saharan Africa	0.54	0.63	0.53	0.47
Europe & Northern America	0.35	0.48	0.43	0.32
Latin America and the Caribbean	0.29	0.16	-0.05	-0.15

Another way of examining the relationship between urbanization and GHG emissions is by correlating the change in the percentage of people residing in urban areas with the change in carbon dioxide equivalent (CO_2e)[90] for the period between 1990 and 2020. The correlation coefficient of 0.15, though positive, shows that the change in the level of urbanization over time is weakly associated with an equivalent change in CO_2. This in turn suggests that changes in GHG emissions per capita are not solely accounted for by changes in urbanization. Consequently, cities are not condemned to facing rising emissions while urbanizing, but rather point to multiple development pathways: some carbon-intensive, others decarbonizing. Such a conclusion speaks to the mitigation potential that is associated with spatially concentrating people, infrastructure and economic activity.[91]

Cities are not condemned to facing rising emissions while urbanizing, but rather point to multiple development pathways: some carbon-intensive, others decarbonizing

Beyond differences that emerge between global regions, the level of economic development and their varied economic roles, variation in emissions extends to differences between and within cities that demonstrate the level of emissions is intimately linked to policy and lifestyle choices and the consumption and production patterns in which these are embedded. This is reflected in the higher correlation (0.50) between the change in GDP per capita and the change in CO_2e between 1990 and 2020, which implies that GHG emissions are more responsive to income/consumption patterns vis-à-vis urbanization. In Europe and North America, where GHG emissions have been declining since 1990, a key driver of consumption-based emissions is energy for heating and cooling. Consequently, several policies at the national and city level have been enacted to promote energy efficiency.[92] Many countries and cities in the region are prioritizing the transition to low-carbon transport, including expanding safe accessible cycle paths and walkways and providing incentives to switch to electric vehicles. This shows that, as with the relationship more generally between urbanization and GHG emissions, even higher levels of wealth—though potentially provoking more carbon-intensive consumption among residents as their incomes increase—do not have to lead inexorably to greater emissions. Indeed,

Many countries and cities in the region are prioritizing the transition to low-carbon transport, including expanding safe accessible cycle paths and walkways and providing incentives to switch to electric vehicles

Clean mobility concept as a means of tackling emmisions. © Scharfsinn/Shutterstock

with the right policies and regulations in place, national and local governments can help facilitate the transition of urban areas to more sustainable systems.

Focusing too much attention on the correlation between urbanization and emissions can obfuscate significant action at the local level. For example, previous estimates have shown that the average emissions for a person living in New York are half those for Denver.[93] Residents of informal settlements emit far less GHG than the residents of gated communities within the same city, a trend further discussed in this chapter. The range between the highest and lowest polluters, at the national, urban and local levels, shows that there is enormous potential to limit GHG, even with existing technologies and practices. It is the high consumption lifestyles of the world's wealthiest neighbourhoods, rather than urbanity itself, which results in the most damaging levels of GHG emissions.[94] Thus, urban residents emit more GHG because urbanization is a generator of wealth, not because cities themselves inherently encourage more emissions.

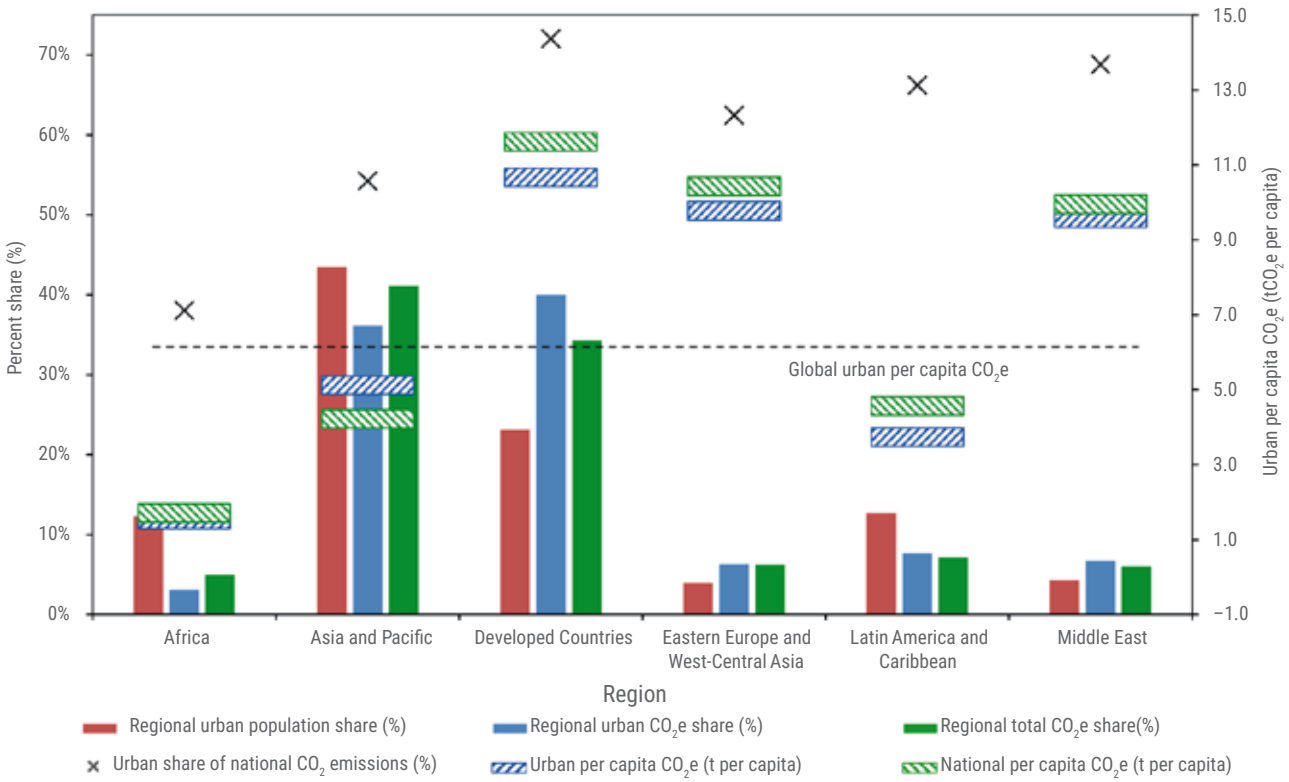
Urban residents emit more GHG because urbanization is a generator of wealth, not because cities themselves inherently encourage more emissions

1.3.3 The potential for urban living to be more sustainable

Various regionally disaggregated studies have both supported and nuanced the idea that urban living is more sustainable than dispersed suburban and rural settlements by comparing emissions per capita in urban areas with the national average. Figure 1.6 uses a "consumption-based" accounting approach—including emissions not only from within urban areas, but also indirect emissions from outside urban areas related to the production of electricity, goods and services consumed in cities—that shows that the difference between per capita CO_2e emissions in urban areas compared to the national level varies by region. The biggest difference is in Latin America and the Caribbean, where average per capita final energy use and urbanization level is lower than national averages (a finding confirmed by other regional studies).[95] This trend is replicated in developed regions, where urban areas have lower CO_2e emissions per capita than non-urban areas.[96] A study of CO_2 emissions in 91 cities across the world concludes that urban per capita emissions tend to be lower than their national average for many developed countries.[97]

In the Asia Pacific region, per capita CO_2e emissions at the urban level tend to be higher than their national average. This region has experienced massive increases in GDP per capita over the past decades. While area-based studies indicate that urban GHG emissions in Asia are lower than national averages,[98] such figures often do not consider energy production occurring outside the cities. When accounting for energy production outside cities, the per capita CO_2e in urban areas tends to be higher than national averages. Such a regional trend is corroborated by a study of 50 cities in Asia, which showed that in the majority per capita final energy use is higher than the national average.[99]

Figure 1.6: Regional comparison of urban per capita CO_2 emissions



Source: IPCC, 2022c

The above-listed rates show a pattern in which per capita emissions in urban areas compared to national averages are relatively high in Asia, almost equal in Africa, and much lower in America and Europe. Figure 1.7: Cluster of cities with GHG emissions per capita (2000-2018) shows four clusters of cities over the period 2000–2018:

- The cities in the *red cluster* had the highest increase in GHG emissions per capita, primarily located in Asia, which has also experienced a very significant rise in income during the corresponding period.

- The cities in the *green cluster* are primarily located in China and are characterized by a very significant rise in per capita emissions, in line with the regionally disaggregated data presented in Figure 1.1: GHG emission (Scope 1) trends, 1990-2018, by sector (top) and region (below)7. However, unlike the cities in the red cluster, these cities have experienced a significant decline in their population density. Indeed, Chinese cities are considered atypical as their GHG emissions tend to be much higher than per capita national averages.[100]

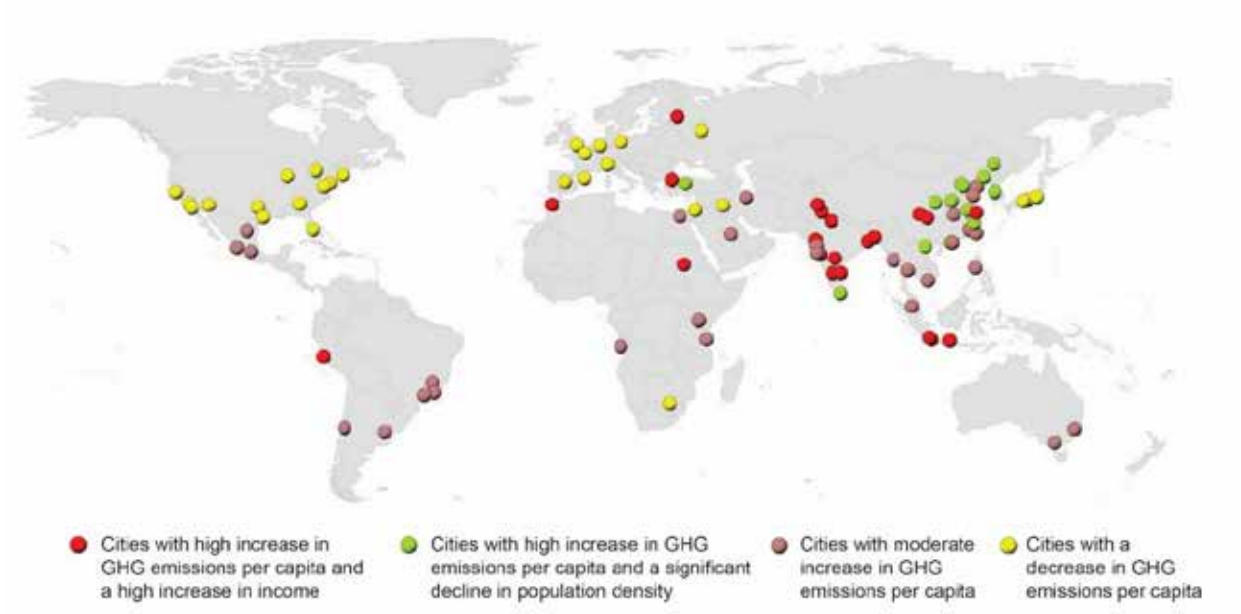
- Cities in the *pink cluster* have experienced a moderate increase in GHG emissions per capita and are mostly located across the developing world.

- Finally, cities in the *yellow cluster* have experienced a decrease in GHG emissions per capita, which are mostly located in developed countries, corresponding with the broader regionally disaggregated data in Figure 1.7.

Such differences are linked not only to different levels of development, but also to the different roles cities play within the global economy. Some serve as "production cities", characterized by a higher share of employment in industrial and export-related functions, while others are "consumption cities" with a higher employment share in service industries and other so-called non-tradables.[101] Area-based accounting of GHG emissions has a distinct bias against production: it is important that cities, in their quest to become net zero, should not be incentivized to simply externalize their polluting industries to other cities or their regional peripheries. For example, in Asia the primary source of GHG emissions in cities is the energy use of industrial and manufacturing processes, which is linked in part to their export economies; in the Americas, on the other hand, the primary source of GHG emissions is from on-road transportation.[102] Such variation implies that effective climate action in cities relies on contextual prioritization based on geographic differences.

In Asia the primary source of GHG emissions in cities is the energy use of industrial and manufacturing processes

Figure 1.7: Cluster of cities with GHG emissions per capita (2000-2018)



Source: Luqman et al., 2023

1.3.4 The relationship of national climate commitments to urbanization levels

Despite the sustainability gains that can be achieved through urban living, urban activities continue to be major sources of GHG emissions. It is therefore important that countries and local governments commit to lower emissions to leverage the potential that urban areas offer for mitigation. The Nationally Determined Contributions (NDCs) set out each country's climate pledge under the 2015 Paris Agreement, capturing both the efforts by each country to reduce its emissions and adapt to the impacts of climate change. As of 2022 there were 34 countries with a long-term emissions reduction target specifically in their NDC,[103] although outside the context of NDCs many countries have committed to full net zero emissions.[104] The NDCs exclude commitments made by cities and other local governments, many of which are more ambitious than those of their national governments.

It is therefore worth investigating if higher levels of urbanization, expressed as the percentage of people living in urban areas, are linked to higher climate commitments. Given that NDC commitments are expressed in different ways, using different baseline years, it is difficult to assess, review and compare the strength of commitments between countries and other variables such as urbanization.[105] What can further compound a meaningful comparison is that the NDCs themselves are sometimes inconsistent within and between versions.

The IMF Climate Dashboard[106] and the World Emissions Clock[107] are methodologies that have been developed to translate the various commitments into estimates indicative of their emissions by 2030. By comparing the implied conditional NDC 2030 targets to the 2020 total CO_2e GHG emissions,[108] a mitigation target can be calculated as a percentage for the period 2020-2030. Figure 1.8: Relationship between urbanization and implied mitigation targets by countries: World Emissions Clock (top) and IMF Climate Dashboard (below)gure 1.8 shows the results of this analysis, plotted against the percentage of population at mid-year residing in urban areas in 2020. The correlation between the level of urbanization and the climate commitments of countries as implied by the World Emissions Clock and IMF Climate Dashboard is weak and negative, suggesting that the level of climate ambition set out by countries in their NDCs is largely independent of their degree of urbanization.

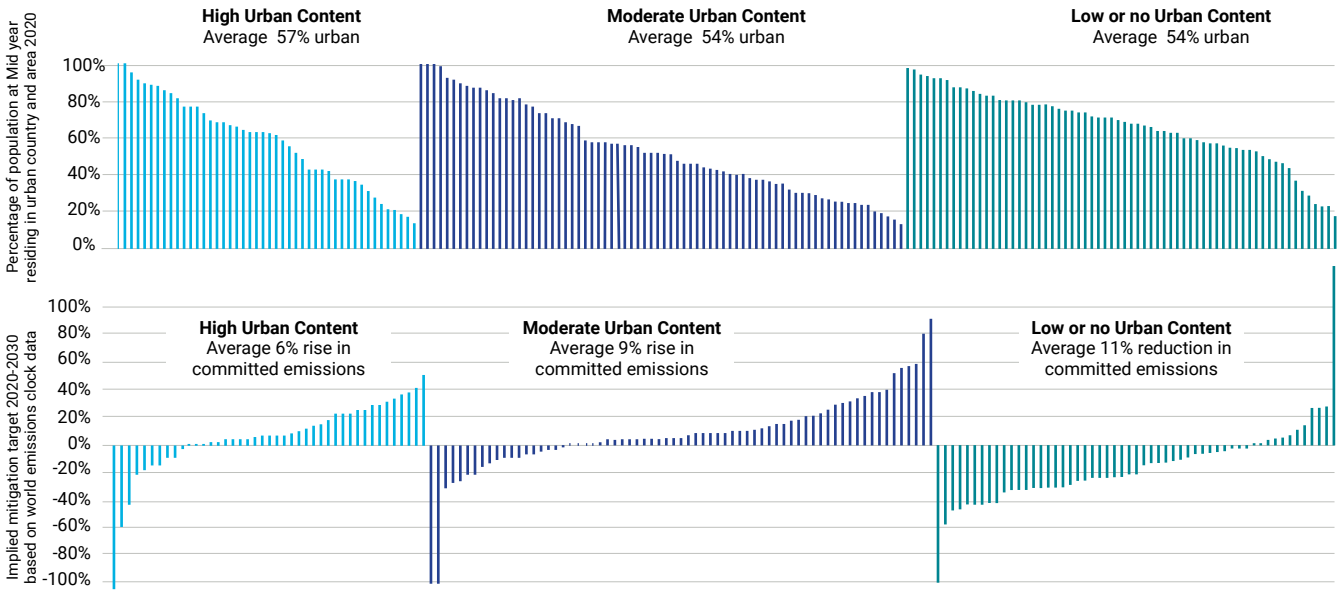
Amman, Jordan © Cristi Croitoru/Shutterstock

Figure 1.8: Relationship between urbanization and implied mitigation targets by countries: World Emissions Clock (top) and IMF Climate Dashboard (below)

It is important to recognize that the NDCs are at best proxies for national policy on cities and climate change. While urban areas are increasingly mentioned within NDCs, there are many countries with longstanding commitments to urban climate action that are not captured in their respective NDCs (the concise consolidated NDC covering all countries of the European Union serves as an example). City-states may not mention "urban content'" explicitly, but in such contexts all climate change mitigation and adaptation commitments should be considered urban. Consequently, the categorization of NDCs as having strong, moderate or low urban content based on a keyword analysis[109] is not strongly related to the strength of each country's implied mitigation target. Indeed, Figure 1.9 shows that countries with low or no urban content in their NDCs have 66.5 per cent of their population residing in urban areas, compared to 57 per cent for countries with high urban content in their NDCs. Countries with low or no urban content in their NDCs committed to an average of 11 per cent reduction in emissions, while those with a high urban content have committed to an average rise in emissions of 6 per cent.

The foregoing implies that whether countries mention urban areas in their NDCs is largely independent of their levels of urbanization. This means that countries have not yet adequately considered urbanization as a driver of emissions, nor explored the solution space offered by sustainable urbanization. Nevertheless, the preparation of NDCs is documented to positively contribute to national climate policy processes by raising awareness and catalyzing institutional change.[110] In this regard, it is important that NDCs explicitly recognize that urban areas should be at the forefront of reinvigorated climate action in their climate policies to overcome sectoral approaches and empower local governments to pursue ambitious climate agendas.[111]

Figure 1.9: Urban content of the NDCs: links to urbanization and the implied mitigation targets



1.4 Urban Development Pathways to Lower GHG Emissions

The primary role of NDCs is to identify and communicate a country's climate targets under the UNFCCC. Countries are not required to define how they intend to achieve the targets in their NDCs. Such actions and implementation strategies on climate action are more commonly captured in the National Climate Action Plans, National Adaptation Plans, as well as in National Urban Policies and National Disaster Risk Reduction strategies, the latter of which have a strong intersectionality with climate action.

While the NDCs focus on commitments, they do provide a starting point for understanding the potential urban development pathways to reducing GHG emissions and adapting to the impacts of climate change. An urban development pathway can be understood as a series of steps, interventions and policy-enabling environments that provide a tangible and realistic transition between present urban conditions and future goals. Such pathways are shared courses of action across society that put at their core the improvement of well-being and prosperity of all people, especially those who are most vulnerable, while reducing carbon emissions and reducing the risks from climate change.[112]

The UNFCCC Synthesis Report notes that the full implementation of all the latest NDCs would lead to a reduction of about 2 per cent in GHG emissions by 2030 relative to the 2019 level.[113] To limit warming to 1.5°C, however, GHG emissions need to be reduced by 43 per cent by 2030 relative to the 2019 level.[114] According to an analysis undertaken by UNEP, the "emissions gap" (the difference between projected global emissions from current country commitments and the commitments needed to limit global warming to a 1.5°C pathway) remains 23 $GtCO_2e$, even if all unconditional NDC commitments have been met.[115] The new and updated NDCs submitted since 2021 reduce projected GHG emissions in 2030 by an additional 0.5 $GtCO_2e$.[116] The current NDCs are therefore insufficient to achieve the Paris Climate Agreement: emission reductions should increase by 80 per cent beyond what is currently in the NDCs even to meet the 2°C target.[117]

Emission reductions should increase by 80 per cent beyond what is currently in the NDCs even to meet the 2°C target

Box 1.2: A selection of potential low-emission pathways for cities to pursue

Since national commitments within the NDCs are insufficient to achieve the Paris Climate Agreement, it is imperative to look at initiatives and high-potential transitions that are not covered by the NDCs. UNFCCC has identified several mitigation options with high net emission reduction potential, together accounting for approximately half of the total emission reductions required to remain on a 1.5°C pathway by 2030.[118] At least three of the high-potential mitigation strategies identified have a clear link to cities and urban areas:

- *Solar energy* (3.3 Gt CO_2 e/year): Solar urban planning, in which both passive and active use of solar energy are integrated into urban planning, is an important emerging field.[119]

- *Reduced conversion of forests and other ecosystems* (2.28 Gt CO_2 eq/year): Reducing urban sprawl and urban consumption of land and resources will play a key role in reducing the conversion of forests and other ecosystems.

- *Energy efficiency improvement in industry* (1.14 Gt CO_2 eq/year): As a primary source of energy consumption, cities can play a key role in enhancing energy efficiency in industries such as construction.

As shown in Chapter 5, cities play a key role in the solution for effective climate action. A subset of subnational and non-governmental multilateral emission reduction initiatives which preceded the Paris Agreement was shown to have the potential to reduce emissions by 5 $GtCO_2e$ by 2030.[120] Accounting for overlaps, the combined achievement of all subnational and non-state transnational emission reduction initiatives could reduce global emissions by 18–21 $GtCO_2e$ per year in 2030.[121] Table 1.2 summarizes several high-potential global mitigation[122] efforts by coalitions of non-governmental agencies and how these are linked to urban areas. Enabling cities, communities, businesses, and local and regional governments to implement their climate action plans should be part of the effort to localize climate action and bring the world closer to a global pathway compatible with the Paris Agreement.

Enabling cities, communities, businesses, and local and regional governments to implement their climate action plans should be part of the effort to localize climate action and bring the world closer to a global pathway compatible with the Paris Agreement

Table 1.2: High potential initiatives to reduce GHG and their links to cities

High-potential initiatives	Potential mitigation impact	Broad goals and objectives	Link to cities
REscale Low Carbon Technology Partnership initiative	min. 5.0 Gt CO_2e /year	An initiative from the private sector to support the deployment of 1.5 TW of additional renewable energy capacity	Urban residents are the main consumers of energy
The Governors' Climate and Forests Task Force (GCFTF)	1.6 to 8.0 Gt CO_2e /year	A coalition of local and regional governments to end forest loss by 2030 and restore deforested and degraded lands	Urban areas are continuing to expand in forests and agricultural areas
The Under2 Coalition	4.6 to 5.2 Gt CO_2e /year	Commitments by local governments to limit their GHG emissions by 80 to 95 per cent below 1990 levels by 2050	Commitment by local governments to be met in urban areas
The Climate Smart Agriculture initiative	min. 3.7 GT CO_2e /year	Coalition that aims to reduce agricultural and land use change emissions by at least 50 per cent by 2030 and 65 per cent by 2050	Urban areas are continuing to expand in forests and agricultural areas
The Science Based Targets initiative	min. 2.7 Gt CO_2e /year	A coalition of companies to keep in line with a 2°C temperature goal	Urban areas should provide enabling conditions for companies to limit GHG
C40 Cities Climate Leadership Group	0.8 to 3.0 Gt CO_2e /year	Network that encourages cities to have climate action plans and to have cities achieve emissions neutrality by 2050	Commitment by local governments to be met in urban areas
The Global Covenant of Mayors for Climate & Energy	1.3 to 1.4 Gt CO_2e /year	Commitment of over 12,500 cities and local governments to reduce GHG	Commitment by local governments to be met in urban areas
Architecture 2030 organization	1.9 to 2.2 Gt CO_2e /year	Built environment stakeholders commit to meet an energy consumption performance standard of 70 per cent below the regional average for that building type	Urban areas represent the majority of current and future built environments
The RE100 climate group initiative	1.1 to 4.0 Gt CO_2e /year	Corporate initiative in which companies commit to source 100 per cent of their electricity from renewable sources by 2030	Urban areas should provide enabling conditions for companies to limit GHG

Source: Developed from Hsu et al., 2020; Lui, 2021; and Data Driven Yale, new Climate Institute, PBL, 2018

Moving from commitments to action, climate action in cities should focus on those solutions that have the highest mitigation potential against the lowest costs. Using data on mitigation potential from Project Drawdown,[123] Table 1.3 presents key climate solutions that are available to cities now along four key sectors. The figures indicate the reduced or sequestered emissions in $GtCO_2e$ that is achievable up to 2050. While cities and local governments are incentivized to explore all climate solutions, they should prioritize solutions that are affordable and with demonstrated co-benefits for urban residents. Some key solutions have a close interface with urban informality: when implementing these, cities with a high share of urban informality need to ensure these solutions are well embedded. The mitigation potential highlighted here focuses on what cities can do to achieve net zero urban development pathways. Chapters 5 and 7 discuss how urban planning and governance frameworks can facilitate these solutions.

Moving from commitments to action, climate action in cities should focus on those solutions that have the highest mitigation potential against the lowest costs

Table 1.3: What cities can do to reduce emissions now

Solutions with significant co-benefits | Nature-based solutions | Solutions that interface with urban informality

	Food and nature	Energy and recyling	Built environment	Transport
Low Cost*	**88.50 Gt CO_2e** **Reduced Food Waste** Very significant urban component since most consumption and waste happens in cities	**10.36 + 4.31 Gt CO_2e** **Recycling + recycled metals** Very significant urban component as most recycling already happens in urban areas, and this is where most consumption occurs. Co-benefits can be realized for lowering pollution. Recycling is currently a major source of informal employment	**15.38 Gt CO_2e** **Insulation** Very significant urban component as most buildings are within urban areas. Potential application of nature-based insulating material and co-benefits through reduction of living costs	**9.06 Gt CO_2e** **Carpooling** Significant urban component as most commuting occurs in urban areas.
	22.04 Gt CO_2e **Tree Plantations** This nature-based solution has significant urban component as there are many opportunities in urban areas to add greenery. Solution has health and well-being co-benefits.	**3.89 Gt CO_2e** **Landfill methane capture** Very significant urban component as there are many methane leaks from landfills	**14.45 Gt CO_2e** **LED Lighting** Very significant urban component as most lighting (within buildings and street lights) are within urban areas	**2.83 Gt CO_2e** **Walkable Cities** Very significant urban component as the densities within urban areas have the conditions to make walkable cities viable, especially in the global south, where most people walk. Significant co-benefits potential to make cities safer, more sociable and inclusive
Med cost	**78.33 Gt CO_2e** **Plant-rich Diets** Significant urban component as many urban residents live in "food deserts without access to plant-rich diets. Plant-rich diets can also have health co-benefits. This solution can be nature-based when food is supplied through urban farming	**31.50 Gt CO_2e** **Clean Cooking** Significant urban component as many urban households, especially in the global south, do not yet have access to clean cooking. Clean cooking can also reduce indoor pollution	**4.04 Gt CO_2e** **High efficiency heat pumps** significant urban component as most buildings are within urban areas	**2.73 +1.39 Gt CO_2e** **Bicycle infrastructure & Electric Bicycles** Very significant urban component as the densities within urban areas have the conditions to make walkable cities viable Significant co-benefits potential to make cities safer, more sociable and inclusive
	1.20 + 0.76 Gt CO_2e **Coastal Wetland Protection & Restoration** Significant nature-based solutions has an urban component as many of the world's biggest cities are in coastal areas. It also provides co-benefits against flooding.	**26.50 + 3,41 Gt CO_2e** **Distributed Solar Photovoltaics & Solar Hot Water** Significant urban component as solar panels can be installed on roofs and close to their consumption to reduce reliance on transmission infrastructure. This method of generating energy is already cheaper than using fossil fuels. Huge potential source of future employment and tool for poverty alleviation	**0.53 Gt CO_2e** **Green and Cool Roofs** Nature-based solution with significant urban component as most buildings are within urban areas.	**9.42 Gt CO_2e** **Public transport** Very significant urban component as urban areas are the only places with the conditions to make public transport viable. Significant co-benefits by freeing up space from car-use and increasing land-value. Much public transport is currently informally operated.
High cost		**6.27 Gt CO_2e** **Waste to Energy** Significant urban component as most waste processing facilities are within urban areas and they have the proximity of energy intensive uses to make waste to energy viable	**7.70 Gt CO_2e** **Alternative cement** Significant urban component as most buildings are within urban areas	**7.66 + 1.61 Gt CO_2e** **Electric & Hybrid cars** Very significant urban component as urban areas are the only places with the conditions to make public transport
		6.18 Gt CO_2e **District heating** Significant urban component as urban areas have the density to make district heating viable	**8.82 Gt CO_2e** **High-performance glass** Significant urban component as most buildings are within urban areas	
			9.55 Gt CO_2e **Building automation systems** Significant urban component as most buildings are within urban areas	

**Cost indication is only indicative and will depend on local context*

Source: Project Drawdown, 2024.

1.5 Embedding Climate Action in Urban Informality

Urban informality is a pervasive feature of urbanization, particularly in cities in developing countries, but increasingly extending into cities in developed countries too. Urban informality encompasses almost every aspect of everyday life, from housing and employment to transport and service provision. In many cities across Africa and Asia, the majority of the population live in informal settlements: in Kabul, Afghanistan, where more than two-fifths (41 per cent) of the entire country's urban dwellers resides, four out of every five people (82 per cent) are based in informal settlements.[124] While informality is often conflated with illegality,[125] urban informality provides a means for people to cope with the failure of formal mechanisms to provide adequate livelihoods. Understanding of urban informality has shifted from a perspective that was focused exclusively on deprivations and illegality to one that interprets urban informality as "an organizing logic… a process of structuration that constitutes the rules of the game".[126] This is a significant shift that is critical for climate policy interventions that work with informality, rather than against it. There is broad consensus that urban informality offers opportunities and challenges for effective climate adaptation.[127] Meaningful engagement with such practices is essential for inclusive climate action in cities, yet the role of informality in appropriate climate adaptation and mitigation strategies remains a key knowledge gap.[128]

1.5.1 Informality and climate vulnerability

The IPCC notes with high confidence that "the most rapid growth in urban vulnerability and exposure has been in cities and settlements where adaptive capacity is limited, especially in unplanned and informal settlements in low- and middle-income nations and in smaller and medium-sized urban centres".[129] Residents of informal settlements and those engaged in the informal economy are particularly vulnerable to extreme weather events. Chapter 4 shows that climate change intersects with other drivers of poverty to create conditions where the urban poor suffer higher damages and are pushed closer to and below the poverty line.

Residents of informal settlements and others engaged in urban informality face the immediate impacts of climate change, while often creating only limited GHG emissions.[130] In Bogotá, Colombia, for instance, the informal recycling system emits fewer GHGs than the city's formal system, due in large part to reuse of materials such as textiles, reduced landfill compared to formal waste collection and more efficient recycling of valuable metal waste.[131] Despite this, their important contribution is frequently overlooked and informal actors may even be actively targeted by authorities. In addition to social marginalization, there is the problem of environmental risk: informal practices are often the most vulnerable to climate change and other shocks due to their "limited adaptive capacity", their concentration in "disaster-prone zones of urban centres" and their "unequal access to urban services".[132]

Residents of informal settlements and others engaged urban informality face the immediate impacts of climate change, while often creating only limited GHG emissions

Nevertheless, the informal governance within slums and informal settlements has been praised by the IPCC as an essential coping and adaptation mechanism through the application of Indigenous knowledge, the harnessing of informal learning and the engagement of neighbourhood associations. Indeed, social networks, grassroots organizations and inclusive partnerships play a pivotal role in addressing climate-related and other challenges facing informal workers and informal settlements.[133] Although there is value in recognizing community resilience within slums and informal settlements, this should not be an excuse to allow vulnerable groups to be constantly hit by crisis after crisis without adequate support.[134] While informal practices have limited adaptive capacity to initiate and finance larger-scale adaptation measures, they have a distinctive adaptive capacity that relies on flexibility and resourcefulness.

The relationship between informality and climate change is shown in Figure 1.10: The impact of increasing levels of informal employment and informal settlement at the country level with climate vulnerability and climate readiness using country-level data on informal employment, informal settlements, as well as climate vulnerability and climate readiness.[135] The graphs show that informal employment has a very high positive correlation (0.82) with climate vulnerability and a negative correlation (-0.64) with climate readiness. Similar correlations exist between the share of informal settlements and climate vulnerability (0.42) and climate readiness (-0.53). This suggests that countries with a higher share of informal employment and informal settlements are more likely to be vulnerable to the effects of climate change. These results are telling, especially in the case of many African countries, where high rates of informal settlement and employment co-exist in precarious contexts often characterized by low disaster preparedness, inadequate early-warning systems, emergency shelters and low social protection.[136] At the same time, developing climate readiness by leveraging investments and converting these into adaptation actions enhances the resilience of informal employment and informal settlements.

Developing climate readiness by leveraging investments and converting these into adaptation actions enhances the resilience of informal employment and informal settlements

People walk past houses in a slum. New Delhi, India © PradeepGaurs/Shutterstock

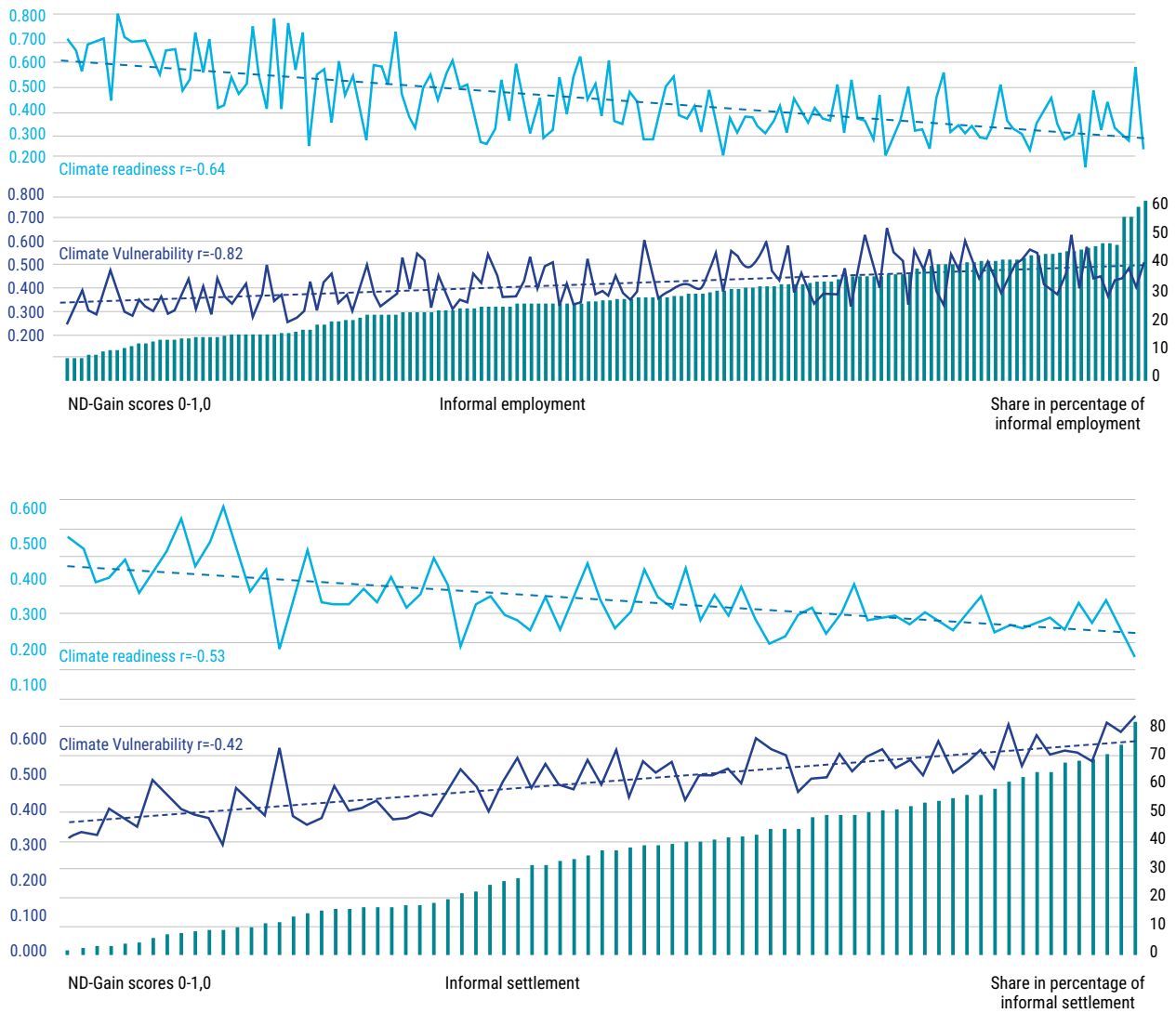
1.5.2 Informal Low-Carbon Pathways

A key opportunity for climate action lies in the way in which many informal practices already embody principles that are aligned with low-carbon pathways. Such low-carbon practices include walking and construction of walkable urban environments, urban agriculture, modular design, environmentally friendly building materials and waste recycling among others.[137] These practices need to be recognized, documented and understood, so that formal interventions can augment and foster these pathways.

A key opportunity for climate action lies in the way in which many informal practices already embody principles that are aligned with low-carbon pathways

Waste collection illustrates such informal low-carbon pathways well, as it often achieves higher levels of coverage than formal systems. By diverting waste materials from landfills, informal collectors increase the quantity of waste that is recycled, thereby generating sizeable environmental benefits.[138] Such informal systems can outperform formal collection not necessarily "because of how its workers recycle, but why they recycle":[139] the economic incentives that effective waste recycling offers, with more efficient collection leading to more income for workers. Other examples of such low-carbon practices are the building of stilted houses to deal with floods or building modifications to allow for more natural airflow through the house.[140] As outlined in more detail in Chapter 8, many ground-breaking sustainable urban practices have either initiated or evolved in the informal sector.

Figure 1.10: The impact of increasing levels of informal employment and informal settlement at the country level with climate vulnerability and climate readiness



It would be naïve to highlight such examples of innovation without acknowledging the unsustainable practices and significant deprivations in informal settlement and employment, such as inadequate water supply or dangerous labour conditions. For example, residents of informal settlements rely mainly on wood-based biomass, a highly polluting energy source that is nevertheless a major component in developing regions such as Sub-Saharan Africa and South Asia, where it makes up 50 and 23 per cent respectively of the urban fuel mix.[141] Within the informal waste and recycling industry, health and livelihood issues exist due to exposure to polluted environments, the handling of hazardous waste and the inability to work during disasters.[142] Indeed, the widespread absence of any environmental or labour regulations within the informal sector mean that its activities can pose threats not only to workers within the sector, but also impact on surrounding communities through toxic contamination, fires and other risks. However, once these issues are recognized, the shortfalls should be approached as opportunities to "leapfrog' to low or zero-emission systems and practices.[143] An example in the context of informal settlements is the adoption of solar panels in community micro-grids, enabling households to leapfrog to decentralized carbon-based energy production.[144] In South Africa, the iShack Project works with communities to supply solar panels in addition to building local enterprising capacity, developing skills and creating green jobs to enhance the resilience of the communities.[145]

Despite the impact of climate change on informal settlements and its tendency to exacerbate the already precarious conditions there, residents often cope with environmental risk as a trade-off to other benefits and have developed coping strategies to deal with negative effects.[146] For instance, those exposed to floods often stay put despite the risks, since their homes often serve as their source of livelihood.[147] Such considerations point to the need to have a community-based vulnerability assessment that foregrounds residents themselves as key evaluators of risk and adaptive capacity. Chapter 3 explores in greater detail how local governments can undertake appropriate vulnerability assessments.

1.5.3 Limitations of current policy initiatives towards informality and climate change

Historically, a limited understanding of informality and its drivers among urban policy makers has contributed in part to slum formation and proliferation.[148] Consequently, climate action in cities must not replicate past mistakes. The distinct anti-informality outlook has prevented many local governments from adequately investing in informally settled urban areas because they are considered illegal, in precarious locations or unworthy of investment. The global stagnation in reducing the total number of people living in slums[149] is indicative of the continuing struggle for the government to adequately acknowledge, incorporate and invest in informal activities and the people that depend on them.

Climate action in cities is often designed to protect existing centres of global investment and infrastructure, and not towards broader environmental and social justice goals that benefit those living in informal settlements.[150] Well-intended climate-responsive land use planning has been documented to produce maladaptive outcomes for historically marginalized residents.[151] "Green" development agendas have been implicated in many forms of displacement and gentrification around the world,[152] and world-class city-making is increasingly aligned with a form of "bourgeois environmentalism" where upper and middle-class residents frame informal settlements as encroachers on green spaces with ecological functions.[153] The eviction of residents from these environments is a form of "eco-cleansing"[154] or "accumulation by green dispossession".[155] These harmful forms of environmentalism extend to approaches to disaster risk management that are premised on the eviction of slum residents as a means to protect "legitimate" residents.[156] Large-scale green infrastructure interventions aimed at generating environmental privileges for upper-class residents often (re) produce inequitable displacement or relocation, threatening informal settlements and livelihoods, weakening social networks, and erasing traditional practices and uses of nature.[157]

Climate action in cities is often designed to protect existing centres of global investment and infrastructure, and not towards broader environmental and social justice goals that benefit those living in informal settlements

Floods stands out as a particular area of concern with regard to maladaptation, as flood control has long been used as an excuse to justify forced eviction.[158] Such climate-related evictions are particularly on the rise in coastal cities in South, South-East and East Asia, where the risk of flooding is especially high.[159] Eviction of informal settlement that has taken place during the last decade along the Gujjar nullah and Orangi nullah in Karachi,[160] the Cooum River in Chennai,[161] the Saigon River in Ho Chi Minh City[162] and the Ciliwung River in Indonesia,[163] displacing thousands in the name of ill-informed climate adaptation.

When governments engage with urban informality, they should refrain from anti-informality approaches aimed at formalization. While formalization in certain contexts can confer benefits to residents, ill-conceived formalization can burden residents with administrative and financial costs that they cannot reasonably bear,[164] drawing people into drawn-out and costly approval processes.[165] In the pursuit of world-class imagery, the urban environment of many informal settlements is needlessly formalized in ways that do not benefit the community. For example, the repressive effect of strict formal building codes on informal settlement and incremental upgrading is widely acknowledged.[166]

Working *with* informality also implies a mindset shift among policymakers that makes them more attuned to the potential challenges of urban informality. Community-level climate initiatives may emerge out of concerns with risks not commonly related to global warming, such as crime, violence against women, food insecurity and unemployment, and such practices can go unnoticed and unsupported when local governments are not attuned.[167] Climate action in an informal context needs to pay attention to communication and language, as the use of abstract concepts such as "resilience" and "adaptive capacity" may be poorly understood, difficult to translate into local languages, or serve to devalue local notions of sustainability.[168]

Rising sea levels as a result of climate change poses severe risks to informal settlements © Fela Sanu/Shutterstock

1.5.4 An opportunity for alignment

In recent years, the focus of overseas development assistance has increasingly shifted towards climate action.[169] This shift, combined with the existence of informal low-carbon pathways and innovations, as well as the enduring inequalities and development deficits that informal workers and residents of informal settlements face, presents a key opportunity for alignment. Indeed, one of the key messages from the UN-Habitat report *Addressing the Most Vulnerable First: Pro-Poor Climate Action in Informal Settlements* is to align efforts in poverty reduction, disaster risk reduction and climate change adaptation, which all share a focus on mitigating local risks.[170] While upgrading informal settlements is not conventionally regarded as a form of climate change adaptation, participatory and community-led improvements can play a central role in building resilience to future disasters, particularly if they include a public health component that addresses potential climate change impacts.[171]

Informal practices need to be supported so they can develop beyond mere coping strategies into adaptive practices and slum upgrading for long-term benefit and development. Significant synergies can be created in this regard. For instance, the mapping that is required to identify and reduce disaster risk also offers the opportunity to undertake enumeration that can support in-situ upgrading and is critical for conferring other benefits, including more secure settlement tenure.[172]

Informal practices need to be supported so they can develop beyond mere coping strategies into adaptive practices and slum upgrading for long-term benefit and development

There is also growing evidence that NbS contribute to livelihood provisions and poverty reduction, through labour-intensive work that can be aligned with job training or "cash for work".[173] Despite such alignment, nature-based adaptation and resilience approaches remain underfunded and under-recognized in urban planning in developing countries.[174] Another example of alignment is the recognition that the provision of social protection schemes has a very significant impact on building climate resilience for informal workers while contributing to broader development agendas.[175]

Nature-based adaptation and resilience approaches remain underfunded and under-recognized in urban planning in developing countries

Such alignment must be premised on the idea that urban informality is not just a context in which to operate, but that its practices must be central to the planning and management of cities to ensure social injustices are not reproduced. In this regard, Figure 1.11: Embedding climate action in a context of urban informality shows key principles that need to underpin climate action in the context of pervasive informality, particularly as it relates to vulnerable groups. Climate action needs to be aligned with development and disaster risk reduction strategies, and to be appropriately localized within communities. Such localization reinterprets the old idea that urban authorities can empower communities to manage and self-regulate their common resources.[176]

Climate action needs to be aligned with development and disaster risk reduction strategies, and to be appropriately localized within communities

Inclusive climate action needs to include ways to enhance more secure tenure, as insecure land rights are issues that have plagued residents of informal settlements for decades, and significantly limit incentives and public support to upgrade their communities in the face of compounding climate risks.[177] The focus of local climate action should not be on formalization as an end in itself, but on achieving justice for those who work and reside within the informal sector, while simultaneously fostering the low-carbon and adaptive practices that characterize many aspects of urban informality.

Figure 1.11: Embedding climate action in a context of urban informality

Vulnerabilties and development deficit

Policy makers and planners need to:

- Identify and address pre-existing inequalities and vulnerabilities to climate change including attention for
  - **vulnerable groups** including children and youth, the eldery, women and people with disabilities
  - geographies of **intersecting and multiple exposures**
- Incorporate development agendas through adressing pre-existing deficits including attention for
  - Insecure land and **housing tenure**
  - Lack of access to **basic services**
  - Job and **income insecurity** and lack of social safety nets
  - **Compromised health** and exposure to environmental hazards
- Look beyond hazards to consider root causes of risk and vulnerability and mainstream risk management into urban development.

Enablers of climate action in a context of urban informality

Policy makers and planners need to:

- **Community enablers**
  - **Co-produce** with communities though inclusive and participatory processes
  - **Empower** local communities and increase the political leverage of poor households
  - **Downscale** vulnerability assessments and responses to city and neighbourhood level
- **Regulatory enablers**
  - **Regulate** in an adaptive manner that support informal practices of entrepreneurship and social innovation while limiting negative impacts on human health and the environment.
  - **Secure** tenure for residents, especially in the face of climate-driven evictions
  - **Decriminalize** informal work that is essential for livelihoods
- **Operational enablers**
  - produce **tangible** results on people's livelihoods in a hierarchy of improvements
  - produce **affordable** solutions both for installion/ construction, as well as for maintenance and repairs
  - **communicate** in a manner that makes complex climate change concepts understandable

Informal low-carbon pathways

Policy makers and planners need to:

- Acknowledge, identify, foster and scale existing green low-carbon processes and outcomes including those from
  - **Building materials** and local sustainable dwelling and construction techniques
  - **Food production** and urban farming
  - **Recycling** and waste management practices
  - Functional mix and **walkable** neighbourhoods
- Foster the related local knowledge, skills, cultures and community networks including
  - **Educate,** train and engage in 'upskilling' of people towards a green economy
  - Support **cultural** institutions and practices
  - Climate adaptation and disaster response **coping strategies**
- Identify and integrate larger scale ecological structures including blue-green networks

Source: Developed from Taylor & Peter, 2014; Brown & McGranahan. 2016; Global Center on Adaptation, 2022; UN-Habitat, 2018.

At the intersection of the existing low-carbon practices within urban informality and the pre-existing development deficits, engagement with urban informality will have to incorporate several enablers, including community enablers, regulatory enablers, and operational enablers (Figure 1.11). Policymakers and planners need to co-produce with local communities through inclusive and participatory processes and downscale vulnerability assessments in a way that empowers these communities. The regulation of informal practices is still often perceived as a singular planning alternative, bringing informal practices "in line" with formal planning frameworks, but this neglects the plurality of the informal regulations that have emerged among residents, and that can form the basis of a much more participatory, adaptive and effective set of regulations.[178]

For many residents in informal settlements, climate adaptation in itself, without any immediate tangible benefits, would not always be considered sufficient reason for the community to adapt to climate risk.[179] In the

Policymakers and planners need to co-produce with local communities through inclusive and participatory processes and downscale vulnerability assessments in a way that empowers these communities

context of informality, climate action needs to achieve tangible and rapid impact in improving people's livelihoods in a way that incrementally builds up to larger-scale, longer-term transformation.[180] To ensure widespread access and financial sustainability of climate adaptation, affordability should be adopted as a key consideration.[181]

1.6 A People-Centred Approach to Climate Action

This section advances a people-centred approach to climate action that promotes effective and inclusive climate action as a framework for building climate resilience in urban areas (Figure 1.12). In the context of urban areas, climate action are initiatives designed to achieve the Paris Agreement, SDG 13 (take urgent action to combat climate change and its impacts) in cities and human settlements, the climate change components of the NUA, and the major milestone decisions reached during various COPs especially as they relate to urban areas. Such actions include but are not limited to mitigating climate change through the reduction of GHG emissions, adapting to the impacts of climate change by building resilience across a wide range of dimensions, reversing of impacts of climate change, and reducing the vulnerability of at-risk individuals, groups, and communities. In practice, well-designed climate change initiatives should cover these actions simultaneously. A people-centred climate action seeks to achieve three things.[182] Through an inclusive process, it identifies and unlocks social and economic benefits that are specifically targeted to ensure equity, while ensuring that the transition away from a high-carbon economy is just and well-managed.

1.6.1 Inclusive climate action: Leaving no one behind

A major thrust of this approach is that urban residents, especially vulnerable groups, must be at the centre of any meaningful climate action in cities and human settlements. Climate action must be inclusive and respond to the needs of specific populations, including children, women, older persons, people living with disabilities, Indigenous Peoples, slum dwellers, refugees and displaced persons (Table 1.4). Chapter 4 shows that these groups are disproportionally affected by the effects of climate change due to their limited access to coping mechanisms and the availability of social protection.

Climate action must be inclusive and respond to the needs of specific populations, including children, women, older persons, people living with disabilities, Indigenous Peoples, slum dwellers, refugees and displaced persons

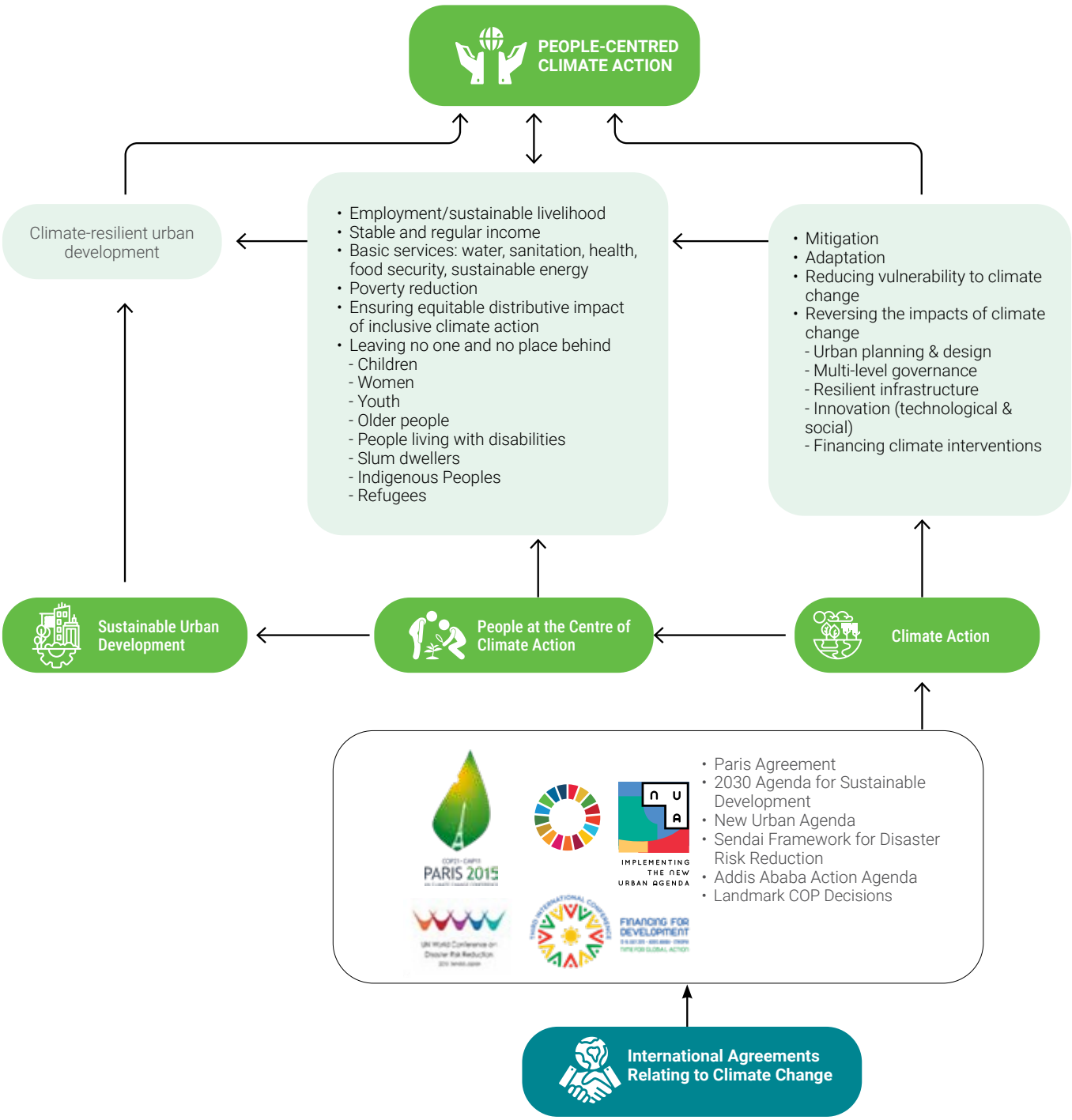
Climate action must respond to the over 780 million people worldwide who are currently exposed to the combined risk of poverty and serious flooding, most of whom reside in developing countries,[183] as well as the 32-132 million people expected to fall into extreme poverty by 2030 on account of the effects of extreme weather conditions.[184] This can be achieved by providing sustainable sources of livelihood, including food and water security and health care, education, health and social protection programmes, to help build resilience. Given that climate change disproportionately affects the poor, eradicating poverty and addressing climate change should not be done in isolation, as both will be much easier to achieve if tackled simultaneously.[185] Without the necessary interventions, climate risks faced by the urban poor will worsen over time. In this regard, climate action should entail building resilience across multiple levels—economic, social, environmental and institutional—to respond to a wide range of shocks, with contingency plans in place for the most vulnerable groups. A case in point is UN-Habitat's Resilient Settlements for the Urban Poor (RISE UP), whereby significant amounts of funding has been mobilized to support community-led urban adaptation and climate resilience programmes in global hotspots of vulnerability.[186]

Climate action must respond to the over 780 million people worldwide who are currently exposed to the combined risk of poverty and serious flooding, most of whom reside in developing countries

Climate action is inclusive when it responds to the needs of persons with disabilities, for whom discrimination and stigma are critical elements (besides poverty) that determine how they are impacted by climate change.[187] Persons with disabilities are often at high risk of being left behind in emergencies and natural disasters. Like most vulnerable groups, they lack meaningful and effective participation and are often an afterthought in climate change decision-making and action (Chapter 4). They are often excluded from the institutional processes by which adaptation decisions are made, thus entrenching existing inequalities and vulnerabilities as opposed to upholding and enhancing their rights and dignity. Nevertheless, people in vulnerable situations in cities are important agents of change as they possess the resilience, knowledge and skills to support effective climate action.[188] Climate action must not entrench existing inequalities and vulnerabilities among the urban population. Instead, it must be human rights-based and inclusive of various interests in urban areas—including, for example, being "disability-inclusive."[189]

People in the streets of Kibera slums, an informal settlement in Nairobi, Kenya © Nick N A /Shutterstock

Figure 1.12: Overview of components of a people-centred approach to climate action



Climate action must address the needs of climate-induced migrants and refugees (Table 1.4). The effects of severe weather and climate events including climate-induced crises have already contributed to the uprooting of millions of people from their homes or country.[190] By 2050, as many as 216 million people could be forced to migrate due to the effects of climate change, with 85.7 million internal climate migrants within Sub-Saharan Africa alone.[191] Increasingly, greater prominence is given to the link between climate change, forced migration, and conflict, which in turn has given rise to the term "climate-security nexus".[192]

Table 1.4: Climate Action and Vulnerable Groups

Groups	Vulnerability to Climate Impacts	Climate Action to Address Vulnerability	Links to SDGs/NUA
Children	▪ Susceptibility to illnesses such as asthma and heatstroke which are exacerbated by extreme heat events and poor air quality associated with climate change. ▪ Climate change negatively impacts the nutrition of children by increasing food insecurity and water scarcity. ▪ Disruption of schooling and children's access to education and future opportunities by extreme weather events.	▪ Inclusive Heatwave Early Warning Systems ▪ Inclusive and accessible cooling centres. ▪ Promoting climate-resilient food systems ▪ Sustainable land management e.g. reforestation and terracing to protect water resource areas and agricultural lands. ▪ Child-centred health and health systems adaptation ▪ Child-centred Disaster Preparedness Plans	▪ Safe, healthy and secure cities. ▪ Equitable access to sustainable basic physical and social infrastructure, housing, drinking water, food, health care, education.
Young people	▪ Disruption of economies and livelihoods such as agriculture, fishing and tourism, affecting young people's employment prospects and income opportunities, and prospects. ▪ Barriers to meaningful participation in decision-making processes and climate action.	▪ Training programs that prepare young people for green jobs and the future of work. ▪ Social safety nets such as employment guarantee schemes to buffer against climate impacts ▪ Foster climate innovation among the youth to promote the diversification of livelihoods. ▪ Participation and leadership in climate change mitigation and adaptation efforts.	▪ Safe, healthy, inclusive and secure cities. ▪ Full and productive employment, decent work and livelihood opportunities. ▪ Access to education and skills development. ▪ Effective participation in decision-making.
Women	▪ Increasing burden of care exacerbated by climate change, despite unequal access to resources such as land and finance. ▪ Vulnerability of pregnant women to extreme weather events such as flooding, heatwaves and hurricanes, increasing the risk of maternal and child mortality and exposure to diseases. ▪ Women are systematically more likely to be economically dependent, making them more vulnerable to climate-related disruptions to livelihoods and income. ▪ Women often have limited decision-making powers, sidelining them from or participation in climate change adaptation and mitigation efforts.	▪ Gender-responsive urban planning incorporates gender considerations into climate change adaptation and mitigation measures. ▪ Strengthen maternal and reproductive health access in disaster response such as mobile clinics during extreme weather disasters. ▪ Diversification of livelihoods to reduce economic dependence. ▪ Capacity building to prepare women for green jobs and the future of work. ▪ Promote women's involvement in climate change decision-making and governance at all levels	▪ Measures to address barriers that disproportionately affect women and girls. ▪ Equitable access to sustainable basic physical and social infrastructure, housing, drinking water, food, health care and education. ▪ Full and productive employment, decent work for all and livelihood opportunities. ▪ Effective participation in decision-making.
Older people	▪ Susceptibility to illnesses or complications associated with pre-existing health conditions exacerbated by extreme weather events including heatwaves and poor air quality. ▪ Limited mobility, physical capabilities and access to emergency services during extreme weather events. ▪ Financial constraints that limit the ability of older people to cope with the impacts of climate change.	▪ Heatwave early warning systems. ▪ Accessible cooling centres. ▪ Upgrading housing and infrastructure to make them more resilient to climate change impacts while addressing the specific needs of older people. ▪ Implementing energy efficiency and retrofit programs targeted at elderly households to reduce energy costs freeing up financial resources for other needs.	▪ Safe, healthy, inclusive and secure cities. ▪ Equitable access to sustainable basic physical and social infrastructure, housing, drinking water, food, health care, culture and information technologies.
Slum dwellers and persons living in informal settlements	▪ Poor access to basic infrastructure and services, which makes residents more vulnerable to climate-related hazards. ▪ Location of slums and informal settlements in hazardous areas increases exposure to natural disasters exacerbated by climate change. ▪ Reliance on informal or precarious livelihoods which are highly vulnerable to climate-related disruptions. ▪ Social marginalization, discrimination, and limited access to decision-making processes.	▪ Slum upgrading programmes that prioritize climate-resilient design principles. ▪ Securing land tenure rights for persons living in informal settlements to enable access to safer housing thus reducing disaster risk and homelessness. ▪ Capacity building and training for green jobs, and green entrepreneurship and innovation. ▪ Participatory urban planning that engages slum dwellers and persons living in informal settlements.	▪ Strengthening and retrofitting all risky housing stock to make it resilient to disasters. ▪ Address multiple forms of discrimination. ▪ Improve living conditions. ▪ Security of land tenure

Groups	Vulnerability to Climate Impacts	Climate Action to Address Vulnerability	Links to SDGs/NUA
Urban poor	▪ Poor access to basic services, adequate housing, healthcare and education, increasing vulnerability to climate change impacts. ▪ Climate change exacerbates extreme poverty by increasing food insecurity and water scarcity. ▪ Reliance on informal or precarious livelihoods such as daily wage jobs, which are highly vulnerable to climate-related disruptions in markets, supply chains, and income sources. ▪ Social exclusion in decision-making processes, which can exacerbate their vulnerability to climate change impacts.	▪ Inclusive urban planning incorporating affordable urban basic services such as affordable housing schemes into climate change adaptation and mitigation measures. ▪ Sustainable land management practices such as terracing, reforestation and erosion control to promote long-term agricultural productivity and water availability. ▪ Climate-resilient food systems ▪ Implementing social protection programs such as cash transfer schemes, food assistance and insurance mechanisms can provide a safety net for the urban poor ▪ Participatory approaches in decision-making processes, capacity-building initiatives and community-based climate projects.	▪ Strengthening and retrofitting all risky housing stock to make it resilient to disasters. ▪ Address multiple forms of discrimination/ ▪ Improve living conditions. ▪ Eradicating poverty.
People with disabilities	▪ Climate-related disasters such as flooding or hurricanes can create physical barriers by damaging infrastructure, thus limiting the mobility and access of people with disabilities and increasing mortality. ▪ Susceptibility to illnesses or complications to pre-existing health conditions exacerbated by extreme weather events and poor air quality ▪ Increased vulnerability due to higher poverty rates, lower levels of education and higher likelihood for unemployment ▪ Barriers to accessing information due to disabilities affecting hearing, sight etc.	▪ Ensuring that early warning and disaster response systems are accessible to people with disabilities through multiple channels. ▪ Invest in inclusive public health systems that consider the unique vulnerabilities of persons with disability to climate change impacts and integrate their needs. ▪ Social safety nets such as cash-transfer programmes, food assistance and affirmative action in employment to protect livelihoods ▪ Mainstreaming disability inclusion in media and communication	▪ Sustainable mobility and transport infrastructure that is responsive to different levels of physical, mental and developmental challenges/ ▪ Safe, healthy, inclusive and secure cities/ ▪ Equitable access to sustainable basic physical and social infrastructure, housing, drinking water, food, health care, culture and information technologies
Refugees and Internally Displaced Persons	▪ Climate change can exacerbate existing drivers of displacement, such as desertification and conflict over natural resources. ▪ Climate-related disasters and environmental changes can disrupt livelihoods leading to reliance on humanitarian assistance. ▪ Displaced populations often lack urban basic services, increasing their vulnerability to illnesses exacerbated by climate change impacts.	▪ Strengthening data collection, monitoring and research efforts on climate-related displacement to inform evidence-based policy and programming responses. ▪ Community-based adaptation and resilience-building initiatives in areas prone to climate-related displacement. ▪ Safe and inclusive shelter options for displaced populations, ensuring that services such housing, healthcare and education is resilient to climate change.	▪ Equitable access to sustainable basic physical and social infrastructure, housing, drinking water, food, health care, culture and information technologies. ▪ Full and productive employment, decent work for all and livelihood opportunities. ▪ Ensuring full respect for human rights.
Indigenous People	▪ Disruption of ecosystems and economies, ▪ affecting Indigenous Peoples' livelihoods including employment. ▪ Climate-induced displacement of Indigenous communities from their ancestral lands. ▪ Political and economic marginalization, discrimination and human rights violations when implementing adaptation and mitigation measures	▪ Community-based adaptation and mitigation that draw upon Indigenous traditional knowledge and local ecological expertise. ▪ Sustainable land management and climate-resilient infrastructure in vulnerable areas occupied by Indigenous Peoples. ▪ Integrating the participation and rights of Indigenous People in adaptation and mitigation measures	▪ The rights of Indigenous Peoples to self-determination, land, and resources, including their right to participate in decision-making processes that affect their communities. ▪ The role of Indigenous knowledge and practices in environmental conservation and sustainable resource management, promoting partnerships between Indigenous communities and urban stakeholders to enhance urban resilience and environmental sustainability.

Groups	Vulnerability to Climate Impacts	Climate Action to Address Vulnerability	Links to SDGs/NUA
Homeless People	▪ Exposure to extreme weather events and other weather-related illnesses. ▪ Limited access to social services, exacerbating their vulnerability during climate-related disasters. ▪ Exclusion from decision-making processes.	▪ Climate-resilient infrastructure and urban design solutions that consider the needs of homeless individuals. ▪ Implementing Housing First Approaches and affordable housing schemes. ▪ Participatory planning that integrates the needs of homeless people in adaptation and mitigation measures.	▪ Support policy that progresses towards the right to adequate housing for all and to prevent arbitrary evictions. ▪ Facilitate full participation in society and eliminate the criminalization of homelessness.

1.6.2 Driving sustainable development through climate action

Climate action offers an opportunity to move the needle forward on all SDGs. This is because of the synergies that exist between climate action and 80 per cent of the targets of the 2030 Agenda for Sustainable Development.[193] Investing in climate action therefore constitutes good practice that can generate development dividends in the form of backward and forward linkages. When carefully designed and implemented, actions to address the adverse effects of climate change should be interrelated and mutually reinforcing. Climate action must not only contribute to adaptation and mitigation efforts, but should also ensure sustainable livelihoods, food security, access to clean water and other basic services including affordable healthcare—all of which will reduce the vulnerability to climate change (Figure 1.12: Overview of components of a people-centred approach to climate action). The impacts of climate change are quite significant, to the extent that adaptation and risk management can be powerful contributors to poverty eradication and sustainable development.[194]

By 2050, as many as 216 million people could be forced to migrate due to the effects of climate change, with 85.7 million internal climate migrants within Sub-Saharan Africa alone

Climate action is most effective when ably supported by NbS. These are designed to protect, sustainably manage or restore green spaces and ecosystems for purposes of addressing societal challenges such as disaster risk, food security, water security or human health.[195] NbS not only protect vulnerable communities from the impacts of climate change, but are cost-effective and strongly aligned with the SDGs.[196] NbS have the potential to deliver around a third of the climate mitigation required to align with the goals of the Paris Agreement, amounting to over 10 Gt CO_2e of reduced GHG emissions per year.[197] However, global investment in NbS needs to increase by almost three-fold, from $200 billion to $545 billion by 2030 to meet the Rio Targets and limit global temperature to the 1.5°C limit.[198]

1.6.3 Planning as inclusive climate action

Planning for inclusive climate action, including the transition to net zero targets, may entail a range of action instruments from zoning, transport planning, densification or building regulations, but they need to be carefully tailored to the existing patterns of urbanization and aligned with the needs of urban dwellers (Chapter 5). Planning strategies to reduce GHG emissions in urban areas include planning and design that supports compact, connected and transit-oriented urban growth; investments in infrastructure for public transit, walking and cycling; and improved solid waste management.[199] Besides reducing GHG emissions, these strategies have a range of economic, environmental and social benefits. Compact urban form brings together various activities and services, reducing the cost of infrastructure provision and enhancing accessibility to jobs, while at the same time minimizing uncontrolled urban expansion and protecting natural ecosystems, biodiversity and food security.

Adaptation planning as climate action provides multiple responses to address the drivers of vulnerability (Chapters 4 and 5). The exposure of cities to climate change impacts is dependent on several interrelated factors, including patterns of urbanization, physical location, exposure to disasters and state of preparedness, among others. Urban planning as climate action must address these issues. In Angola, a priority area is the promotion of risk-informed urban planning and sectoral coordination to reduce exposure to flooding, heatwaves and droughts, which in turn helps build the resilience of vulnerable groups.[200]

The exposure of cities to climate change impacts is dependent on several interrelated factors, including patterns of urbanization, physical location, exposure to disasters and state of preparedness, among others

A recognition of the situated experiences of risk and vulnerability, as well as the differential capacities to reduce carbon emissions and cope with hazards, is essential to deliver just climate action outcomes. Planners and policymakers must avoid a situation in which climate action reproduces and even exacerbates existing inequalities. This is particularly the case when climate action does not take into consideration the social, economic and environmental needs of the most vulnerable communities. For example, with appropriate social protection mechanisms in place, climate urbanism interventions can push up land prices and make "improved" areas unaffordable for poor residents, potentially leading to gentrification or displacement.[201]

1.6.4 Resilient infrastructure as effective climate action

Climate-resilient infrastructure and associated services can serve as crucial targets for effective climate action in urban areas. Natural disasters cost the global economy an estimated US$14.6 billion annually in infrastructure loss and destroy an estimated 7.5 per cent of the world's road and railway systems.[202] In response, cities are increasingly investing in climate-smart and resilient infrastructure (Chapter 6). This

Planners and policymakers must avoid a situation in which climate action reproduces and even exacerbates existing inequalities

is in line with the notion that crucial infrastructure systems will be increasingly vulnerable if design standards do not account for changing climate conditions.[203] Besides their environmental value, investments in climate-resilient infrastructure bring significant social and economic co-benefits that enhance their cost effectiveness. As discussed in Chapter 9, one study has estimated that every US$1 invested in resilient infrastructure in low- and middle-income countries could bring US$4 in benefits.[204]

Providing adequate infrastructure in the form of improved water and sanitation, reliable power supply, efficient transport networks and modern information and communication technologies (ICT) contributes to the resilience of urban areas, especially in low-income and informal settlements. Since infrastructure in developing countries must be provided to meet the needs of a growing population, against a backdrop of rapid urbanization and growing vulnerability to climate change, it is important that new infrastructure is climate-resilient. In the case of Africa, most of the infrastructure to accommodate rapidly expanding urban areas is yet to be built.[205] Moreover, much of this ongoing urbanization is largely informal, occurring in peri-urban, flood-prone or ecologically fragile areas that are highly vulnerable to extreme weather events.[206] This provides an opportunity to build resilience into new infrastructure that will enhance service delivery, increase asset lifetime and lower GHG emissions.

1.6.5 Multi-level governance as climate action

Since the effects of climate change transcend jurisdictional boundaries, no single level of government irrespective of its resources can address them alone. Moreover, climate change policies are subject to complex trade-offs, synergies and interactions, which means a non-siloed approach is imperative. This calls for coordinated multi-level and intergovernmental responses and interventions to climate action, as many of the climate risks that urban areas face require coordination with other jurisdictions (Chapter 7).

Since the effects of climate change transcend jurisdictional boundaries, no single level of government irrespective of its resources can address them alone

In this regard, there is a growing movement of local and regional governments advancing the localization of the global agendas to drive climate action.[207] Urban areas of all sizes, from megacities to small municipalities, have demonstrated that effective climate action is attainable.[208] However, this is only possible when enabling conditions at the city, national and international levels are realized. Managing climate change and delivering responses capable of limiting global warming to 1.5°C requires participatory governance and political frameworks encompassing non-state actors, networks and informal institutions. Resource pooling from multiple levels of government and other actors is possible when institutions are flexible enough to allow for both top-down and bottom-up activity.[209]

1.6.6 Leveraging innovation for inclusive climate action

Climate action is one of the areas that has witnessed the rapid proliferation of innovative solutions. The urgency to decarbonize is driving the convergence of innovation in green and smart technologies. "Innovation—in institutions, understanding, technology and leadership"[210] will be crucial in achieving the goals of the Paris Agreement. The thinking is that the climate target of 1.5°C can only be reached if new technologies are developed at speed. According to some experts, advances in artificial intelligence and digital technology could bring about a reduction of between 4 and 10 per cent in global CO_2 emissions by 2030, rising to 20 per cent by 2050.[211] Elsewhere, it has suggested that the roll-out of a variety of climate technologies at scale could reduce emissions by as much as 90 per cent.[212] While the interdependency of these technologies is high, their levels of maturity vary remarkably, so the scalability and deployment of these technologies will take some time.

The climate target of 1.5°C can only be reached if new technologies are developed at speed

Technological innovation is a necessary condition for addressing the complex social, economic and behavioural aspects of climate change, delivering solutions such as renewable and nuclear energy, energy storage, carbon capture and energy-efficient systems. However, on its own it is insufficient: social innovation is also crucial for implementing these technologies effectively. As a result, climate action has expanded beyond the technological realm to encompass behaviour change and social norms, recognizing the crucial role of societal transformation in addressing climate change. Chapter 8 notes that by fostering new ideas, approaches and collaborations, social innovation plays a vital role in shaping policy agendas and driving transformative policies to promote equity and sustainability.

1.6.7 Finance: A key enabler of inclusive climate action

Finance has been described as "the great enabler of climate action".[213] The scale of investment required to transition to net zero and adapt to climate change is enormous. The Paris Agreement recognizes the importance of making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.[214] Climate finance plays at least three major roles:

- to *reduce emissions* through the transition from fossil fuels to renewable and cleaner forms of energy.
- to *fund adaptation* to the impacts of climate change by building resilience across a wide range of sectors.
- to *pay for loss and damage*.

Besides the huge funding gaps in advancing the transition to cleaner energy and enhancing resilience in developing countries,[215] climate finance is often concentrated at the level of international and national governments, making it difficult for cities to effectively fund climate

Delegates during a session of the World Climate Action Summit in Dubai © Mark Field /COP28

action.[216] Indeed, some estimates suggest that less than 10 per cent of climate finance trickles down to the local level.[217] Chapter 9 shows that wide financial gaps have implications for meaningful climate intervention at the city level.

Climate finance is often concentrated at the level of international and national governments, making it difficult for cities to effectively fund climate action

Mitigation receives far more attention and funding support than adaptation as 90 per cent of all climate finance in 2021 was devoted to the mitigation of GHG emissions.[218] Climate adaptation, on the other hand, is often neglected in climate financing, despite being an investment priority of developing countries as a basis for achieving sustainable development and poverty reduction. Funding for adaptation generally ranges between 20 and 25 per cent of committed concessional finance.[219]

Mitigation receives far more attention and funding support than adaptation as 90 per cent of all climate finance in 2021 was devoted to the mitigation of GHG emissions

A key question dominating climate finance is how the recently agreed loss and damage fund can be operationalized in cities as a financial mechanism for climate justice and equity. It remains uncertain how the fund will work and how much money developed countries will provide. It is estimated that up to US$387 billion might be needed by developing countries every year until 2030 to adequately respond to climate change and its impacts, yet so far only a fraction of this has been pledged.[220] The operationalization of the loss and damage fund is further discussed in Chapter 9.

1.7 Concluding Remarks

In conclusion, this report provides a greater understanding of the role that urban areas can play in addressing the existential threat posed by climate change. In so doing, it explores how urban areas can be positioned to take effective action towards achieving the Paris Agreement of limiting global warming to 1.5°C above pre-industrial levels and adapting to the impacts of climate change by building resilience across a wide range of dimensions. The report articulates the role that cities can realistically play in the drive towards a net zero or low-carbon world, as well as identify the supportive structures needed to effectively play this role. Throughout the volume, the urgency of moving beyond plans, promises and rhetoric to achieve transformative climate action at scale is stressed. The report identifies the persistent bottlenecks in implementation and critically interrogates why climate action in cities is not moving as quickly as it should, given the devastation that climate change is already exacting in many urban areas—impacts that are only going to escalate in the coming years without bold and meaningful action.

The implementation of effective and inclusive climate action, as described in the preceding sections of this chapter, should culminate in building climate resilience across multiple dimensions in urban areas. Emphasis should be on the implementability of the actions leading to climate resilience by the different levels of government, businesses and relevant stakeholders. Building climate resilience involves implementing mitigation and adaptation options to support sustainable development for all.[221] In the case of this report, this applies mainly to sustainable urbanization (Figure 1.12). Realizing climate resilience in urban areas entails taking the necessary steps to reverse the impacts of climate change and reduce the vulnerability of at-risk communities, groups and individuals (Table 1.4). Climate resilience can help develop the capacity for effective and inclusive climate action and contribute to a reduction of GHG emissions, while facilitating adaptation options that enhance social, economic and ecological resilience to climate change.[222]

In building climate resilience for all, it is important to address the social and economic inequalities associated with gender, poverty, race/ethnicity, disability, religion, age or location that compound vulnerability to climate change and further exacerbate injustice.[223] The pathways for achieving climate-resilient development are shared courses of action that put at their core the improvement of the well-being and prosperity of all people, especially those who are most vulnerable while reducing carbon emissions and reducing the risks from climate change.[224] This resonates with the people-centred approach to climate action in cities and communities which this report advances. Such pathways are attainable but require collective effort at various levels—global, regional, national, subnational and local—including a wide range of stakeholders in different contexts.

Building climate resilience is a multisectoral, multidimensional and multi-stakeholder effort, which requires effective collaboration and cooperation across various scales since the dimensions of climate resilience are interrelated and mutually reinforcing. Realizing climate resilience in urban areas requires a combination of multi-level governance strategies with efforts to localize climate action. Localization efforts respond to the call for action on the ground, in which local governments play a central role. Chapter 7 shows that local governments have demonstrated their capacity to deliver interventions for climate change on the ground, but these are hampered by limited autonomy. To be effective, local governments must be supported by a network of actors able to operate at different scales, aligning governmental efforts from the national to the local level, business interests and the efforts of multiple actors within civil society. Key to supporting these efforts is *inclusive* multilateralism, which entails bringing more groups to the table, including non-party stakeholders such as youth, women, Indigenous Peoples and others, alongside those of international networks that have supported local action for climate change. [225]

Endnotes

1 UN-Habitat, 2011.
2 United Nations, 2019c.
3 Schipper et al., 2022; London School of Hygiene and Tropical Medicine, 2022.
4 United Nations, 2021a.
5 UNFCCC, 2022d.
6 Steel & DesRoche et al. 2022.
7 Copernicus Climate Change Service, 2024; WMO, 2023.
8 United Nations, 2023d.
9 WMO, 2022.
10 United Nations, 2022c.
11 Mountford, 2019.
12 UNDP, 2024b.
13 Li et al., 2023.
14 WMO, 2023b.
15 WMO, 2023c.
16 Li et al., 2023.
17 Swiss Re, 2021.
18 United Nations, 2015b.
19 The Economist, 2024.
20 UNEP, 2022c.
21 United Nations, 2023.
22 UNFCCC, 2023c.
23 SEI et al., 2023, p.4.
24 SEI et al., 2023, p.vii.
25 Black et al., 2023.
26 Climate Action Tracker, 2022.
27 Climate Action Tracker, 2022.
28 IEA, 2022, p.3.
29 IEA, 2022.
30 UNFCCC, 2022a.
31 UNFCCC, 2023e.
32 UNDP, 2023a.
33 UNDP, 2023a.
34 UNDP, 2023a.
35 UNDP, 2023a.
36 UN-Habitat, 2011.
37 Dodman et al., 2019.
38 Luqman et al., 2012.
39 Tian et al., 2022.
40 Corbane et al., 2020.
41 Satterthwaite, 2009.
42 Gebre & Gebremedhin, 2019.
43 UN-Habitat, 2011.
44 Byers et al., 2018.
45 UNDRR, 2019a.
46 Gu, 2019.
47 IPCC, 2022a.
48 UCCRN, 2018.
49 Kaspersen et al., 2017.
50 UCCRN, 2018.
51 Souverjins et al., 2022.
52 Fuller et al., 2022.
53 Chu et al., 2019.
54 Adegun, 2017.
55 Circle Economy, 2020; Williams, 2021.
56 Curtis, 2003.
57 Mohai et al., 2009.
58 Anguelovski et al., 2016.
59 Norman et al., 2006.
60 Wright & Fulton, 2005.
61 Matsumoto et al., 2019.
62 Ahmad et al., 2015; Marcotullio et al., 2012; Marcotullio et al., 2014.
63 Selmoune et al., 2020.
64 Wynes & Nicholas, 2017.
65 Fransen et al., 2022.
66 Creutzig et al., 2015.
67 Pablo-Romero et al., 2018.
68 UN-Habitat, 2011; Castán Broto & Bulkeley, 2013.
69 Allam et al., 2020.
70 Farrelly & Brown, 2011.
71 Seyfang & Haxeltine, 2012.
72 Matsumoto et al., 2019.
73 Data Driven Yale et al., 2018
74 Cities Alliance, 2015.
75 UCLG, 2021.
76 United Nations, 2022a.
77 Global Covenant of Mayors for Climate and Energy, 2022.
78 IPCC, 2014a, p.25.
79 IEA, 2008.
80 Marcotullio et al., 2013.
81 Crippa et al., 2021.
82 Pathak et al., 2022, p.94.
83 Brenner & Schmid, 2015.
84 Lamb et al., 2021.
85 UNEP, 2022b, pp.xvi, 41.
86 UN-Habitat, 2011.
87 A similar pattern of declining correlation is replicated when urbanization is correlated with both electricity consumption and energy use per capita.
88 Sethi & Creutzig, 2023.
89 Castells-Quintana et al., 2021.
90 "A carbon dioxide equivalent or CO_2 equivalent, abbreviated as (CO_2e) is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential". Eurostat, n.d.
91 Coalition for Urban transitions, 2019.
92 Economidou et al., 2020.
93 Hoornweg et al., 2011.
94 Dodman, 2009.
95 Grubler et al., 2012.
96 Marcotullio et al., 2014.
97 Luqman et al., 2023.
98 Marcotullio et al., 2012.
99 Grubler, 2012.
100 Hoornweg, 2011.
101 Jedwab et al., 2022.
102 Wei et al., 2021.
103 Fransen, 2022.
104 Energy and Climate Intelligence Unit, 2024.
105 Pauw et al., 2018.
106 IMF, 2024.
107 World Data Lab, 2024.
108 IMF excludes Land Use, Land use Change and Forestry (LULUCF), while the World Emissions Clock includes it.
109 UN-Habitat, 2022a.
110 Röser et al., 2020.
111 Coalition for Urban Transitions, 2019.
112 Schipper et al., 2022.
113 UNFCC, 2023c, para.8.
114 IPCC, 2022b, p.17.
115 UNEP, 2022, p.xvi.
116 UNEP, 2022, xvi.
117 Liu et al., 2021.
118 UNFCCC, 2023c, para.181.
119 Akrofi & Okitasari, 2022.
120 Roelfsema et al., 2018.
121 Lui, 2021.
122 Hsu et al., 2020.
123 Project Drawdown, 2024.
124 Shahraki et al., 2020.
125 Perlman, 2005.
126 AlSayyad & Roy, 2004.
127 Brown & McGranahan, 2016.
128 Oke et al., 2022.
129 Dodman et al., 2022.
130 Satterthwaite et al., 2018.
131 Vergera et al., 2016.
132 Dodman et al., 2022.
133 Dodman et al., 2023.
134 Kaika, 2017.
135 University of Notre Dame, 2024.
136 Global Center on Adaptation, 2022.
137 Satterthwaite et al., 2018.
138 Vergara et al., 2016.
139 Vergara et al., 2016.
140 Parvin et al., 2016.
141 Seto et al., 2014.
142 Dodman et al., 2023.
143 UN-Habitat, 2018a.
144 Amupolo et al., 2022.
145 iShack, 2024.
146 Johnson et al., 2021.
147 Texier, 2008.
148 Finn & Cobbinah, 2023.
149 UN-Habitat, 2023b.
150 Shi et al., 2016.
151 Anguelovski et al., 2016.
152 Kaika, 2017.
153 Baviskar, 2020.
154 Wong et al., 2018.
155 Safransky, 2014.
156 Alvarez & Cardenas, 2019.
157 Anguelovski et al., 2019.
158 Van Voorst & Hellman, 2015.
159 Gu, 2019.
160 OHCHR, 2021.
161 Coelho & Raman, 2010.
162 Harms, 2020.
163 Dovey et al., 2019.
164 Payne et al., 2009.
165 Njoh, 2017.
166 Laquian, 1983.
167 Lizarralde, 2022.
168 Chmutina et al., 2020.
169 Michaelowa & Michaelowa, 2007.
170 UN-Habitat, 2018a.
171 Satterthwaite et al., 2020.
172 UN-Habitat, 2018a.
173 UN-Habitat, 2023e.
174 UN-Habitat, 2023e.
175 Bharadwaj et al., 2022.
176 Ostrom, 1990.
177 Finn & Cobbinah, 2023.
178 Van Oostrum & Shafique, 2023.
179 Ziervogel, 2021.
180 Taylor & Peter, 2014.
181 Taylor & Peter, 2014.
182 Mountford et al., 2019.
183 Chancel et al., 2023.
184 Jafino et al., 2020.
185 World Economic Forum, 2023.
186 UN-Habitat, 2024b.
187 United Nations, 2020.
188 United Nations, 2022d.
189 United Nations, 2020.
190 Berchin et al., 2017.
191 Clement et al., 2021.
192 Gavin, 2024.
193 United Nations, 2023b, p.5.
194 World Bank, 2020.
195 IFRC, 2021.
196 Griscom, 2022.
197 Griscom, 2022.
198 UNEP, 2022e.
199 World Bank, 2022.
200 World Bank, 2022.
201 Castán Broto & Robin, 2021
202 IPCC, 2022a.
203 IPCC, 2022a.
204 Hallegate et al., 2019b, p.2.
205 UN-Habitat, 2020a, p.18.
206 Tellman et al., 2021.
207 UN-Habitat, 2020a.
208 C40 Cities, 2022c4.
209 Sharifi & Yamagata, 2017.
210 Levin & Steer, 2021.
211 World Economic Forum, 2022c.
212 McKinsey & Company, 2023.
213 UNFCCC, 2023b.
214 UNFCCC, 2016.
215 Replace with UNDP, 2023b.
216 Climate Policy Initiative, 2021.
217 Soanes et al., 2017.
218 Hebbale, 2022.
219 Global Center on Adaptation, 2022.
220 UNDP, 2024b.
221 Schipper et al., 2022.
222 IPCC, 2022c
223 IPCC, 2022c
224 IPCC, 2022c
225 UNFCCC, 2022.

Eindhoven, The Netherlands © Shutterstock