Integrating Mitigation and Adaptation

Pathways for urban climate resilience and justice

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Introduction

In cities, climate change adaptation and mitigation are often treated as separate streams, one focused on preparing for climate impacts, and the other on reducing emissions, which can result in tradeoffs in benefits and missed synergies.

This booklet provides an introduction to adaptation and mitigation approaches and presents nature-based solutions as one of the key opportunities to integrate them.

This booklet is a summary of the NetZeroCities report '*Futures deepdive - Integrating Adaptation and Mitigation'.* To learn more, access the log in to the EU Mission Portal and full report here.

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Climate change mitigation and adaptation

Mitigation and adaptation are the primary strategies for responding to climate change and form the two key elements of preparedness for its negative impacts. The urgency of addressing both simultaneously, while avoiding the risks of maladaptation, has become increasingly evident[7].

Cities contribute over 70% of CO2 emissions and are particularly vulnerable to climate change, as they house the majority of the global human population[20]. This significant role in both contributing to and suffering from climate change effects has made cities crucial agents of climate action[10].

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Mitigation

Strategies and actions aimed at tackling the direct root cause of climate change – the concentration of greenhouse gases in the atmosphere, either by reducing the amount of released emissions or reducing the current concentration of CO2 by increasing carbon sinks[7]. Mitigation is at the core of actions for carbon neutrality targets. e.g. Net Zero by 2050.

Adaptation

The process of adjustment in response to actual or expected climate change effects. Adaptation measures are designed to minimise harm and capitalise on potential opportunities[7]. It focuses on building resilience in both ecological and societal systems. In ecological systems, adaptation is the process of autonomous adjustment to the current climate and its effects through ecological and evolutionary processes. Ecological systems are capable of adapting and mitigating within limits[7].

Maladaptation

Refers to actions that inadvertently increase vulnerability to climate change or exacerbate its impacts on people, biodiversity and ecosystems. These outcomes may include higher greenhouse gas emissions, increased vulnerability, reduced equity, or decreased welfare[7]. Marginalised groups are particularly vulnerable to the adverse effects of maladaptation.

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Mitigation and adaptation should be viewed as interdependent strategies — like two sides of the same coin.[6] A combined understanding of adaptation and mitigation is an opportunity to increase societal resilience.

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Mitigation prevails over adaptation

According to research, from a large sample of 885 European cities, **75% have adopted mitigation strategies alone, while 57% consider both mitigation and adaptation plans.**[3] No city had implemented adaptation plans alone. Similar conclusions have been reached by other studies [5–13–16–18–19]. The prevalence of mitigation is attributed to several interconnected factors, fundamentally arising from **cities' governance capacities** for implementing both policies, as well as **international networks and agreements** that inadvertently promote mitigation over adaptation.

National climate priorities tend to align with international policy objectives, which are supported by strong regulatory frameworks and offer long-term global benefits. The external support from international networks, reinforced by national priorities, provides a framework for city action that often includes **technical and financial resources supporting the implementation of mitigation** strategies.

Mitigation actions are perceived as more cost-effective in urban planning because they address evident existing sustainability goals, whereas adaptation strategies are typically more localised and lack equivalent legislative support. As a result, there is a **disparity in resource allocation,** with more efforts being directed toward reducing CO2 emissions than building resilience[7].

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The urgent need for mitigation-adaptation integration

Despite the advancements, **mitigation actions alone cannot resolve the current impacts of climate change.** For instance, even if the goals of Net Zero are met by 2050, weather extremes will still be on the rise[6]. Given the urgency of climate impact, the need to implement holistic strategies combining mitigation and adaptation is broadly recognised.

If well-implemented, integrated strategies can result in **synergies** of climate action that are able to build resilience while having positive effects on cutting and/or absorbing greenhouse emissions[21]. However, they can also lead to **trade-offs** that exacerbate the negative effects of climate change and/or affect the capacity of communities to cope with its effects[21].

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SYNERGIES

Carbon sequestration that simultaneously reduces exposure to climate change impacts (e.g. reforestation that reduces landslide hazard, mangrove restoration that reduces coastal hazards).

GHG emissions reduction that simultaneously reduces exposure to climate change impacts (e.g. increasing urban green spaces to reduce urban heat island effect).

DIFFERENCES

Different knowledge and information required to inform policy making

Distinct stakeholders

Distinct distributional impacts
(global mitigation vs. local adaptation benefits)

TRADE-OFFS

Mitigation actions that increase exposure and vulnerability to climate change
(e.g. hydropower investments in hazard prone areas)

Adaptation actions that undermine mitigation efforts
(e.g. air conditioning investments)

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Synergies and Trade-Offs

Sector	Synergies	Trade-offs
Urban green infrastructure	Green infrastructure, such as parks, green roofs, and urban forests, naturally contribute to carbon sequestration while enhancing urban resilience by providing stormwater management and reducing heat islands, further reducing energy demands for cooling.	The implementation and management of green infrastructure may involve significant emissions of CO2 depending on the type of infrastructure and context. Emissions are reported mainly from transport and machinery during the construction, and from the use of fertilisers and irrigation during management.
Building design	Passive building design related to albedo, shading, orientation, and natural ventilation reduces need for air conditioning and helps in achieving thermal comfort during heatwaves.	Air conditioning of hospitals and elderly homes and vulnerable populations are effective adaptation measures. However, unless renewable energy sources are used, they considerably increase the energy demand and emissions.
Urban design and land use planning	Compact urban development emphasising density, land use mix, and improved connectivity promotes active and public transportation, reducing energy demands for travelling. As habitation space is smaller, it reduces energy for cooling and heating buildings and water consumption.	Highly dense urban areas with limited green and open spaces can intensify heat islands and intensify the energy for cooling. Increased density and rapid growth of high-rise buildings has resulted in intensive demand for steel with negative consequences for mitigation.

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Synergies and Trade-Offs

Sector	Synergies	Trade-offs
Energy	Decentralised and distributed energy systems based on renewable sources reduce emissions, improve efficiency, and are less reliant on water use. They enhance resilience by minimising the risk of component failures and reducing vulnerability during storms, floods, and extreme temperature events.	Redundant energy infrastructure based on renewable sources still demands substantial capital investment, which can undermine the distributional benefits of the energy transition. This may limit the availability of resources for other critical adaptation measures, such as poverty alleviation, particularly in vulnerable localities.
Water	Water efficiency measures are primarily linked to adaptation, but they also contribute indirectly to mitigation due to the close connection between water and energy. Rainwater harvesting can be used for non-potable purposes, easing water scarcity, while rainwater and greywater recycling can reduce the energy demand for freshwater treatment.	Adaptation measures to address water scarcity can be costly and may increase emissions due to the water-energy nexus. For example, desalination plants can enhance water supply resilience but are both expensive and energy-intensive. Similarly, rainwater harvesting systems, while beneficial, can lead to cost-related trade-offs.
Transport	Active and public transportation, combined with economic measures such (fuel and vehicle taxation, parking) can offer multiple co-benefits, including increased physical activity and reduced air pollution. Enhanced adaptive capacities result on cost savings, improved public health, and lower congestion-related costs, such as productivity losses.	Implementing efficient active and public transportation systems requires large-scale infrastructure modifications, resulting in direct emissions. Additionally, the management of such infrastructure may lead to gentrification and the displacement of vulnerable, low-income users. Vehicle and fuel taxes, along with public transport tariffs, can also disproportionately impact low-income households, exacerbating financial burdens and loss of jobs.

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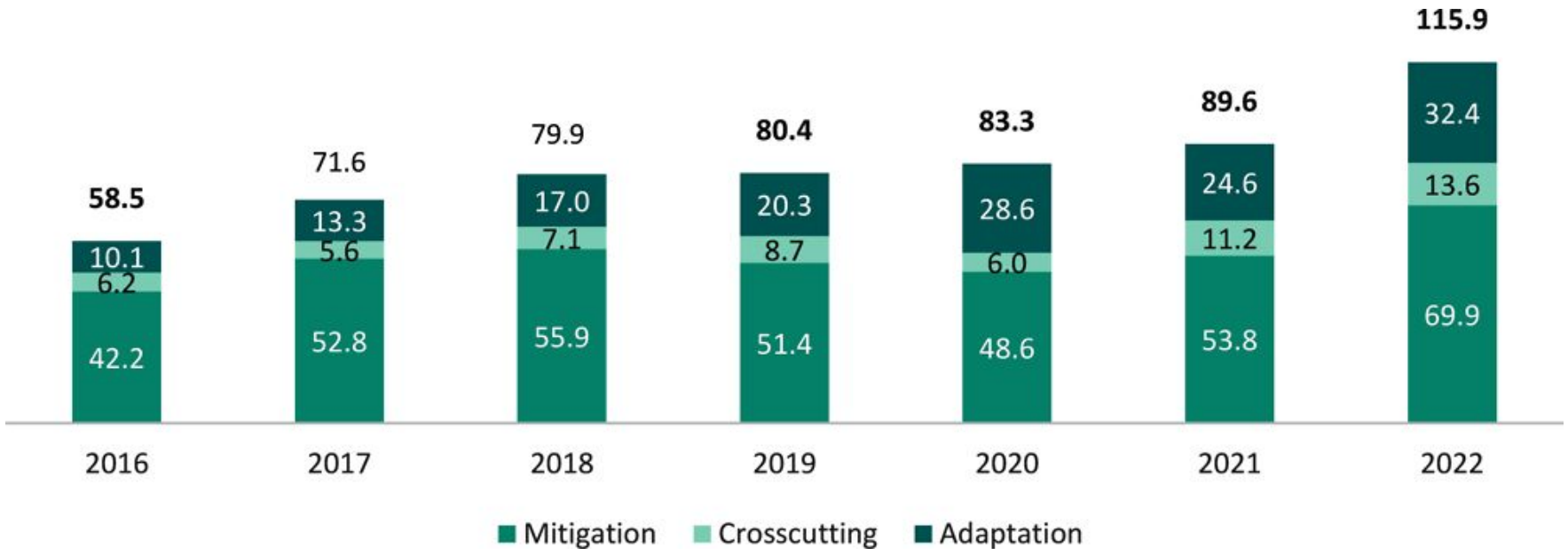
Climate Finance Imbalance: The Need for Integrated Mitigation–Adaptation Funding

An overwhelming **majority of funds are directed to mitigation**[7–23]. In fact, only 1.2% of total urban climate finance flows (USD 10 billion) are directed to adaptation[17]. Furthermore, only USD 7 billion are used for multiple objectives including both mitigation and adaptation[17]. As a consequence, even though climate finance has shown a positive trend in recent years, the current financial schemes are insufficient and limit the development of adaptation options[8]. In other words, **siloed finance upholds siloed policies and easily leads to maladaptation**.



Thematic split of climate finance provided and mobilised between 2016 and 2022 in USD (Source: OECD)

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Nature-based solutions for integrated adaptation and mitigation

Nature-based solutions can be defined as:

"Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges *(climate change, natural disasters, social and economic development, human health, food security, water security, ecosystem degradation and biodiversity loss)* effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." (**IUCN, Nature-based solutions**).

Some examples of NbS are:

- **Green infrastructure:** green roofs and green walls to reduce heat islands, manage stormwater and enhance habitat and food for pollinators.
- **Street trees and urban forests:** to reduce air pollution and promote wellbeing.
- **Permeable surfaces:** to absorb and filter rainwater and reduce flood risks.
- **Coastal buffer zones:** restore dunes, mangroves and marshes to protect against storms and higher sea levels while providing habitats for wildlife

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NbS are perceived as a great promise for climate action

91% of European cities contemplate NbS in their mitigation and/or adaptation plans[1] and as a first step for integrating mitigation and adaptation measures[15–12]. This is due to the **great array of perceived co-benefits and synergies for mitigation and adaptation** when implementing solutions that include green infrastructure and their recognised effectiveness in providing risk reduction and enhancing environmental resilience while simultaneously absorbing and storing CO2.

> **NbS are generally highlighted as effective in improving bioretention to manage stormwaters and improving building insulation to manage heat islands, which reduces the energy demands, enhances biodiversity and improves human health and wellbeing[20].**

Ecosystem-based mitigation and adaptation actions are context-specific and from a broad array of existing solutions not all are equally effective. If not well implemented, **they can lead to trade-offs and maladaptation.** For example, NbS initiatives are less likely to be implemented in lower-income neighbourhoods. At the same time, if social aspects are not integrated into their planning, NbS can lead to issues of green gentrification [18].

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Planning with Nature's Complexity: New Directions for Urban NbS

New definitions of NbS (see IUCN definition) are shifting from a problem-solving approach that prioritises development needs to a **broader recognition of societal needs and the interconnected needs of all species within urban areas**[18]. This shift embraces a more relational socio-ecological ontology, acknowledging the shared factors affecting both vulnerable human communities and ecosystems, and celebrates the entanglement of human and ecological well-being in city planning.

However, this evolution raises questions about how to effectively operationalize and institutionalise these ideas in urban planning while accounting for the complexity and unpredictability of nature and its metabolic processes and still addressing the effects of climate change.

Some directions point toward expanding the scope of climate-biodiversity urban action to include a broader range of concerns, such as ethics, justice, and inclusion in decision-making in a more direct relation to urban nature. For instance, the concept of "multi-species justice" has been increasingly proposed as a promising framework to address interrelated vulnerabilities[18].

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Pathways for cities

Governance innovations for integrating climate actions

Knowledge and capacity supporting place-based approaches

Define local climate objectives

Enhance local participation to address vulnerabilities

Expand engaged sectors

Ensure funding integration

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Governance innovations for integrating climate actions

To transcend the mitigation and adaptation dichotomy and align these strategies with broader societal and environmental goals, **cities should move towards breaking down silos within governance structures and fostering integration across city departments.** Adopting a multi-level governance approach ensures that climate actions are matched to the appropriate level of government and the specific needs of different communities, enabling more targeted and effective responses.

Climate adaptation and mitigation must be treated as horizontal issues that permeate all areas of urban policy, while maintaining clear ownership and accountability to ensure these strategies are effectively implemented. Importantly, **cities must continue further developing their adaptation strategies while continuing to advance their mitigation efforts.** It is essential to communicate that adaptation and mitigation work hand in hand, with neither being sacrificed for the other, to ensure a balanced and just response to the climate crisis.

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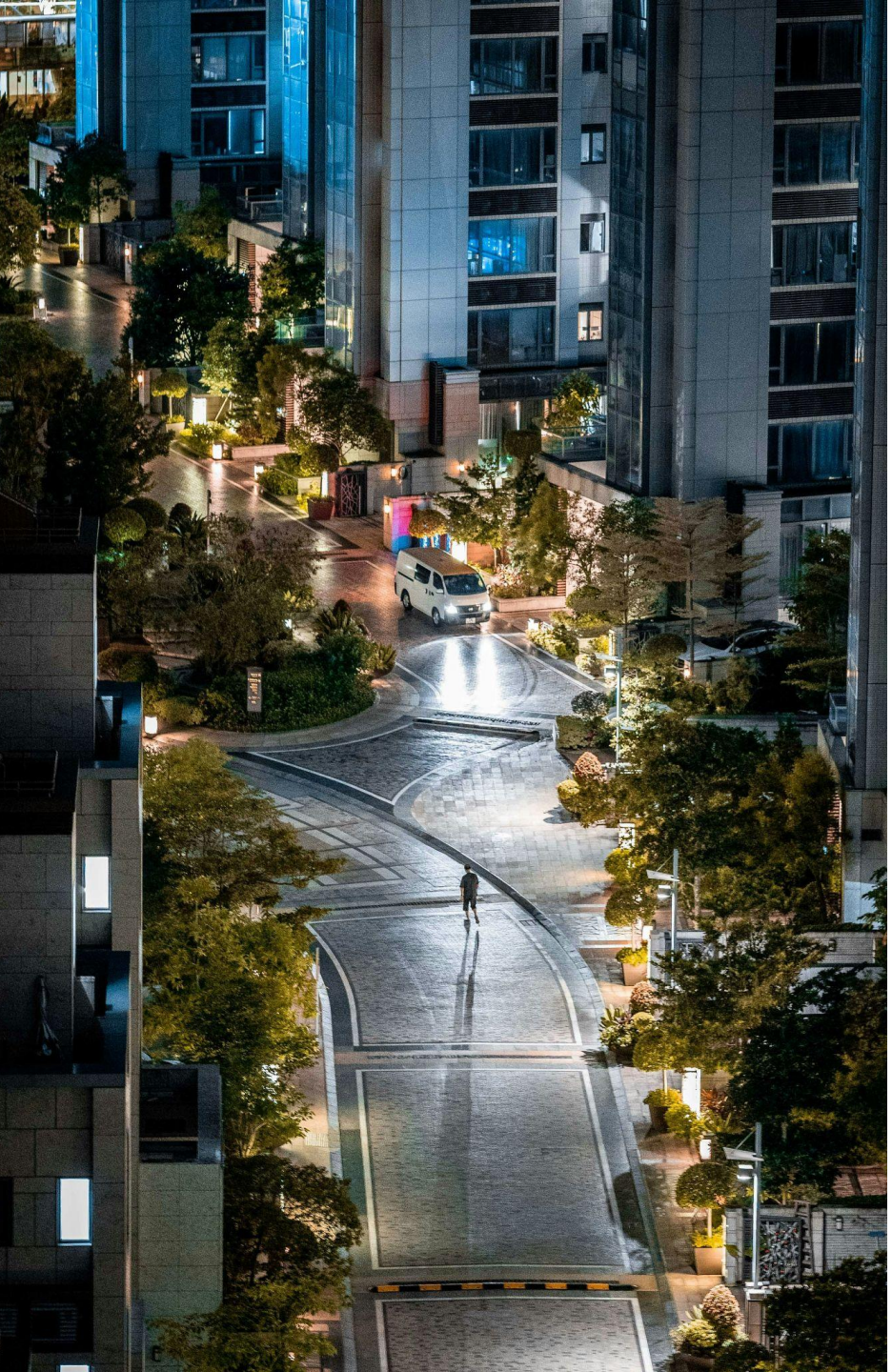

Knowledge and capacity supporting place-based approaches

To integrate climate strategies, cities should develop both technical and non-technical capacities, incorporating new knowledge and learning tailored to their unique contexts. This involves building a deep understanding of their specific adaptation needs, as well as recognizing the synergies and trade-offs that arise when combining these efforts with mitigation actions.

By doing so, cities can enhance their self-determination, pursuing solutions that are best suited to their local realities. While established networks and programs can provide valuable support, it is crucial that the knowledge they offer is adapted to fit local circumstances. **Cities should also leverage peer learning, especially with other cities facing similar challenges, and explore transformative capacities such as foresight, innovation, experimentation and embedding awareness.**

Defining local climate objectives

Cities must go beyond national and international targets to define their own climate objectives in collaboration with their communities. To achieve this, climate action should broaden its scope to incorporate often-overlooked dimensions like dignity, care, and well-being.

It is essential to build on the evolving climate narratives that emphasise ethical and human-centred approaches, reimagining climate action in ways that connect these human dimensions to environmental integrity.

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Enhance local participation to address vulnerabilities

Local participation is essential to ensure that climate actions are inclusive and represent the diverse voices within a community, particularly those of vulnerable and marginalised groups. The recognition of local intersectional needs is crucial when defining adaptation objectives and preferred strategies. Cities should move beyond conventional "citizen engagement" models to embrace a deeper understanding of different perspectives, using concrete co-creation tools that foster genuine collaboration.

Exploring different emerging frameworks (e.g. intersectionality, multispecies justice) can help cities to learn and internalise the broad diversity of perspectives and work toward ethics of care and inclusion.

Expand engaged sectors

Cities must expand their collaborations beyond the traditional sectors involved in climate strategy — such as environmental departments, land management, infrastructure, transportation, energy, water management, business, finance, and academia — and actively engage with other sectors that play a crucial role in climate transitions.

Since climate change adaptation will disproportionately impact livelihoods, **sectors that ensure peace, safety, equity, and resource access are particularly important. These include food production, healthcare and public health, human welfare organisations, security sectors, and cultural institutions**. Besides, integrating adaptation as a lens within these sectors is essential, requiring capacity building to equip them with the necessary tools and knowledge to effectively contribute to climate resilience.

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Ensure funding integration

Cities must shift from a project-based to a program-based approach to funding to ensure a more comprehensive and sustained climate action. Building capacity for climate response includes equipping cities with the skills to navigate complex financing landscapes, secure available funds, and allocate them effectively, ensuring that both mitigation and adaptation actions are adequately supported. Integration between local governments and funding institutions is crucial, with an emphasis on aligning financing with long-term local adaptation objectives.

This approach should consider both short- and long-term time scales, reinforcing the need for immediate investments to secure future resilience. Cities should also question frugal fiscal policies that restrict proactive and preventive actions, recognizing that such policies may hinder self-determination. **Cities should partner with public, private and third sectors to leverage diverse resources to fund the initiatives that align with their specific needs.**

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