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Turning the tide—why cities can be both drivers of climate change and biodiversity loss, and leaders in tackling them

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Preface. This perspective uses the key features of the “city” system to prevent the triad of climate, biodiversity and socio-economic inequality crises from worsening. In other words, global change key drivers know how to make things better. The perspective discusses the idea of cities as both a cause and a solution to planetary challenges, such as climate change, biodiversity loss and socio-environmental as well as health inequalities. Unlike many other articles on urbanisation as a driver of environmental problems, this article does not focus exclusively on this role. Instead, it links urbanisation to its tremendous potential to both cause and solve these environmental problems, drawing on the enormous innovative and communicative talent inherent in cities and urban societies. It offers a fresh, serious yet optimistic look at the role of cities in the global race to prevent critical tipping points for a broad urban-focused audience.

KEYWORDS

urban system, cities, climate change, tipping points, transformative change, responsive policies

Fundamental changes ahead challenging an increasingly urban world

As our planet undergoes fundamental changes, the stability of social and economic structures is also being called into question. Whether climate change, species extinction or socio-economic inequality, critical thresholds have been reached everywhere (Tomalka et al., 2024). And these thresholds are closely interlinked, spatially and functionally: When we think about the threat to habitats for all species—humans, plants and animals. In order to effect a change in the prevailing circumstances, it is primary imperative that we implement wide-ranging and fundamental societal transformations. That means we have to ameliorate the egregious disparities in wealth, education and income. Above all, it is essential to engage in open and conflict-inclusive communication about these urgently needed transformations. This communication must address both the change-related losses (Reckwitz, 2024) suffered and the options for (re-)gain involving an application of the broad and reliable body of knowledge we have. Here is both, an inventory and a perspective on how this can be achieved which ultimately places cities as decisive units or entities at the centre. In other words, this polemic sets out the argument that in particular cities and their urban populations are capable of exerting a significant influence on these fundamental changes, namely all—climate change, biodiversity loss and socio-economic inequities. This way, they could serve as frontrunners in the fight against the consequences of the causes,

and the causes themselves, which they themselves generate, i.e. to a certain extent to be against one's own way. If we let them.

But first things first.

Our earth is heading towards several critical turning points

Our globe is a complex, constantly evolving system. Any changes are therefore largely irreversible, which means that there is no way back to the *status quo ante*: Even if global warming were to be reduced to 1.5 °C again after exceeding critical limits, a collapsed (tropical or other) forest will not be able to re-develop in a climate-shaping way. And a dead coral reef will not simply rise again. What is more, persistent multiyear droughts develop into a growing threat to nature and humans, especially in densely populated urban areas (Chen et al., 2025). Neither the North Pole would most probably not freeze over again, nor the increased sea level would not return to pre-industrialisation levels or the year 2015 of the 1.5-degree Paris Agreement for several millennia. Thus, novel coastal landscapes, including urbanized areas and coastal cities, will inevitably emerge. And not just in the lower latitudes, but everywhere. And most likely even faster in Europe than in other regions of the world, which would entail a dramatic sequence of loss and gain with a very concrete physical manifestation, namely in terms of space and place (van Oldenborgh et al., 2009). Numerous scientific studies warn that the global climate system and the rapidly declining biodiversity could be put into a state in which they irretrievably lose their stability as a result of human impact (Lenton et al., 2023). Many elements of the earth system can initially buffer external influences, are then stressed, but still appear stable and unchanged. At some point, however, it becomes too much, a threshold value is reached and one more drop causes the proverbial barrel to overflow. Then a tipping point is passed, not yet to be confused with an ecosystem or societal turn (see Hillebrand et al., 2023, for biodiversity and ecosystem change; Bentley et al., 2014; Milkoreit, 2023, for social system change and social tipping points).

Cascades of feedback

Typical characteristics of a tipping point are accelerated changes after a threshold has been crossed, which are often self-reinforcing due to feedback effects. The development can then neither be stopped nor controlled until a completely different, more stable and often irreversible system state is reached, to which both, society and the economy, must then adapt. The new system states could fundamentally change the living conditions on our planet - with potentially devastating consequences for humanity and its societies (Dombrowsky et al., 2024), especially in its concentrated form in cities. The probability and depth of such a system transformation are characterised by feedback loops and tipping points in the Earth system. If, for example, the planetary boundary of species and biodiversity loss is exceeded, other tipping points also shift and the system as a whole becomes more sensitive and fragile (Rockström et al., 2024). It can, therefore, happen that the crossing of one system boundary influences others and also contributes to boundary crossings there: For example, it makes

the risk of zoonoses and pandemics more likely (Rupasinghe et al., 2022).

The positive feedback of the tipping points and the resulting domino effect is known as the tipping cascade. The more the planetary boundaries are exceeded, the closer we come to this tipping cascade. The planetary boundaries, such as the changing climate, biodiversity and ecosystem integrity, not only define ecological thresholds, but also have profound and potentially irreversible effects on the socio-economic fabric of our societies, again, in particular of our core settlement areas, the cities: If wheat and maize no longer grow due to climate conditions in Central Europe, if the irrigation of agricultural crops becomes impossible due to, at least temporary, water shortages, if fruit and other foods no longer thrive due to a lack of pollinators, i.e. insects, if climate-related healthcare costs in cities become so high that healthcare systems collapse, then there is a risk of widespread societal collapse, spatial segregation and fortressing and, inescapable, deep conflicts ahead as we experienced during the corona crisis (Armocida et al., 2020). It is almost impossible to predict exactly when the ecological limits will be exceeded or when critical species diversity levels will be undercut, and trophic systems will collapse, partly because these types of feedback loops are not yet fully integrated into climate models, just as little as social feedback (Rockström et al., 2024). The current plans to reduce emissions on the one hand and to protect biodiversity. On the other, may therefore not be sufficient to adequately limit future global warming and the loss of habitats and biodiversity.

Societies and their social and economic as well as cultural systems are once again an order of magnitude more complex, making it difficult to predict societal reactions and conflicts. However, the importance of reduction and adaptation processes as well as protective measures for the non-human living world can hardly be overemphasised. Recent studies show that the ecological and social 'tipping point risk' increases with every tenth of a degree above 1.5 °C of global warming, and even faster with an increase of over 2.0 °C (Emmerling et al., 2024), which is already exceeded today. At the same time, recent health studies show that humans have been adapting to global warming since the middle of the 20th century. Thus, the effects of heat on morbidity and mortality have been progressively reduced when cold related deaths are also included (Pintor, 2024). However, it is not possible to predict when the limits will be reached.

Tipping is an ongoing property of the system

Thresholds and tipping points exist in ecosystems and biodiversity systems, but also in our (post)modern (neo)liberal economic and social systems, including cities. They may have different origins, but in all cases, it is difficult to predict either their exact location or their timing. The fact that they have been crossed is usually only realised afterwards, when it is too late. One such tipping point was reached in the financial crisis of 2008, at first glance an economic feature, at second glance an urban economic feature, when the first major bank collapsed, the fragility of financial market structures became apparent and the entire financial industry had to be rescued by the state, which had previously often been

demonised. Other tipping points were the oil and gas price crises of the 1970s and 2022, which led to a far-reaching restructuring of the energy system. The most impressive political tipping point was the collapse of the Soviet Union and the socialist pact system 35 years ago, triggered by economic and social upheaval, similar to the French Revolution more than 200 years ago. The former created an enormous path dependency with violent consequences such as the war in Yugoslavia or Russia's current war of aggression against Ukraine (D'Anieri, 2023). Not to be forgotten at this point is the Arab Revolution in the 2010s, which most likely among others had climate change-related triggers, namely persistent drought (Kaniewski et al., 2012). Today, there is a looming threat of systemic change, if it has not already become apparent, in the so-called 'illiberal democracies' and under the leadership of far-right political parties. The fundamental objective of politics must therefore not be to allow events to run their natural course until the established limits are reached and then intervene (if such intervention is indeed possible). Instead, the fundamental objective of politics must be to maintain a safe distance from the danger zone and to prepare adequately for the inevitable crises that will arise. And here we can and must draw a connection to climate change, the loss of biodiversity and the resulting increasing incidence of vector jumps between animals and humans, but also between wild animals and farm animals.

Society has immanent momentum when embracing its ambivalence

We are already so close to the tipping points of the Earth system that the targeted creation and activation of positive tipping points to redirect economic and social trends are the only realistic option for limiting systemic risk (see Snizhko et al., 2024, for the Ukraine under war). This requires political action and societal mobilization, broad scope for understanding and judgement including ambivalent views, changes in behaviour and norms building on this, and, at the end, considerable financial investment and technological innovation (Hernandez et al., 2024). The electricity sector in many countries has recently passed the tipping point of cost parity for renewable electricity generation. However, the momentum of decarbonisation has so far been held back by billions in subsidies for fossil fuels, which therefore urgently need to be reduced (Østergaard et al., 2022). In addition, measures to avoid energy-intensive activities and to shift to less energy-intensive activities, i.e. sufficiency policy, are still lacking. However, there will not be a revival of coal and nuclear power, but the pure futile endeavours to achieve this may cost time and money, which will then be sorely lacking for climate protection. Worse still is the example of proxy decisions at the COP16, the United Nations Biodiversity Conference, in Cali, Colombia, in Pusan, South Korea, or Lisbon, Portugal, at the failed plastic waste summits, all in 2024 or 2025: Most visible in Cali, token progress was celebrated by recognising the core role of indigenous peoples in biodiversity conservation, as if this decision had made any effective contribution to mitigating the current loss of biodiversity (Euronews, 2024).

To explain what I mean, let's look at just one example: The most important political measure would be the introduction and enforcement of strict sector-specific limits and targets that force

technical and organisational innovations and have a knock-on effect on other sectors - creating positive tipping points. This opportunity was offered by the Climate Protection Act with its sector targets but was removed due to a lack of interest and assertiveness on the part of several European governments, for example. Instead, the survival of the fossil fuel industry is being ensured by conservative ministries across the continent through technical sham solutions such as CCS (CO₂ capture and storage) at a cost of billions.

This example makes clear, that both necessary scale and speed of change can only be achieved with sufficient public consent and acknowledging societal ambivalences (Haase and Dushkova, 2024): Instead of reducing participation rights with fast-track laws, the public should be involved in the relevant decision-making processes and a clear understanding, on the one hand. Enormous opportunities, above all saved lives, improved health and wellbeing, better jobs, clean and cheap energy, as well as the risks and losses of rapid change, on the other. Crisis preparation and climate adaptation, together with honest communication that does not conceal the burdens of transformation but offers help to the socially vulnerable and low-income households in particular, are necessary not only to avoid overburdening institutions. For successful transformative change, there is also a restoration of the damaged credibility of politics and government action needed (Hernandez et al., 2024). Listening to the concerns of citizens, exchanging viewpoints between different peer groups, looking for solutions together and keeping promises strengthens democracy and removes one of the strongest current obstacles to transformation, the rise of right-wing radicalism (Jylhä et al., 2020).

Avoiding ecological tipping points by respecting planetary boundaries is of central importance for the continued existence of our civilisation and of nature itself. To achieve this, far-reaching social and economic changes are needed that develop sustainable economic systems, strengthen socio-environmental distributional, procedural and interactional justice (Low, 2017) and improve international cooperation, namely transformations that can only become effective in time through positive tipping points (Everall et al., 2024).

To turn the tide according to the polluter pays principle—the role of cities

The accumulation and manifestation of collective and individual experiences of permanent change including gain and loss of, on the one hand, and unequal access to natural resources and biodiversity is a subject that has been the focus of much scholarly attention (Temper et al., 2015). As demonstrated in this text, cities and urban societies are frontrunners in several senses. Firstly, they now concentrate almost 60% of the world's population (UN-Habitat, 2025). Secondly, they are among the main causes of the processes of climate change and biodiversity loss discussed here. At the same time, cities are frontrunners in driving, experiencing and negotiating change: Cities are subject to a material transformation of their (non)-built substance, which takes place either disruptively through human-made wars, place-based ecological disasters or authoritarian urban redevelopment. Or cities force an incremental process of creative destruction through societally, economically or politically motivated renewal (Kılış et al., 2024).

However, losses that are inextricably linked to these dynamics are experienced, remembered and dealt with in divergent ways in urban areas. And Reckwitz (2024) speaks here of individual losses or perceived declines as well as those specific to society as a whole or income classes ('decline' of the middle class's which is definitely most pronounced in cities). Consequently, cities function as the social arenas for the discursive negotiation and narrative processing of experiences of loss and gain that arise as a result of transformations in demographic, social, political and environmental factors, including climate change and biodiversity. The narratives and memories associated with these experiences find their systemic and spatial expression in the city and beyond (the peri-urban). And it is precisely the role of cities and urban societies as co-creators of crises and losses as well as the sites of their negotiation for the future to crosslink these thoughts to what was said above about current biodiversity loss "...to make use of diverse sources of information to better account for the diverse relations between people, other species and the ecological, social, cultural, economic, technical and increasingly digital structures that they are embedded in" (Andersson et al., 2024; p.813).

In consideration of this background, the analysis of how experiences of loss, in more general, for example, when cities shrink, when cities get flooded or when cities lose its nature and biological diversity, are addressed and processed in their spatial narratives (e.g. mourning, nostalgia, protest, etc.) becomes a central element for comprehending late modern urban development and pivotal for any future of and in cities facing global change. An examination of the urban conditions of loss illuminates both the heterogeneous losses in the city and at the same time how cities deal with it, adapt or negotiate fundamental changes and ultimately implement them. These fundamental transformations affect and can rely on the whole urban system including social structures, identities, communicative processes of conflict, negotiation or compromise, and their spatial, urban natural, semi-natural designed and built forms of expression.

Utilising the polluter-pays principle and the polluter-pays responsibility wisely but imperatively would offer a realistic opportunity to prevent or at least mitigate the global tipping points, discussed in the first part of this perspective, be they of climate, biodiversity or inequality nature. The protection of planetary boundaries is therefore not at all only an environmental or ecological necessity, but also a social and political one, in order to secure a sustainable and more just future for all. Therefore, it is no longer a question of intellectual subjunctive but of practical imperative that cities, as the centre of life for almost 60% of the world's population, should be given a leading role in international decision-making on sustainable development, and not just nation states. Existing networks include the UNESCO Global Network of Learning Cities (GNLC) and the C40, a global network of nearly 100 mayors from leading cities who are united in acting against the climate crisis. They have large potential to drive greater sustainability and transformative change than has been realised so far.

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Data availability statement

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The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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