Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice

Abstract
Cities are key in climate mitigation and adaptation, and they have developed into sites of innovative urban climate governance that can spur on climate action. Building on this development, a rich scholarship (within earth system governance and beyond) is now available that seeks to understand the development and performance of urban climate governance around the world. This article systematically reviews a decade of urban climate governance scholarship (building on 260 publications from 2009-2018). It is informed by four research challenges that were identified by leading scholars of urban climate governance a decade ago. The article seeks to understand how much progress has been made in the literature during this decade, and to identify the key research challenges for the critical decade that lies ahead of us.

1 Introduction
It is often stressed that cities are point-sources of activities and behaviour that contribute to climate change. It is also often stressed that it will be in cities that the consequences of climate change will be felt most severely. At the same time, cities are widely considered as the places where behavioural, economic, and technological interventions for climate change adaptation and mitigation have the best potential to be implemented and scaled up (IPCC 2018). Seeking to utilise their climate mitigation and adaptation potential, cities around the globe have developed as sites of innovative and experimental governance to spur on climate action (Rosenzweig et al. 2018). Following these developments, scholarly interest in urban climate governance has grown rapidly (Luque-Ayala, Marvin, and Bulkeley 2018, Romero-Lankao, Burch, and Hughes 2018).

This rapid growth of scholarly interest is a promising development, but it also raises questions of what has been learned about urban climate governance, what are the core knowledge gaps that we face today, and how these gaps might be best addressed in the critical decade to come. These questions very much resonate with those asked by urban climate governance scholars at the end of the first decade of the twenty-first century (e.g., Bulkeley 2010, Betsill and Bulkeley 2007, Sippel and Jenssen 2009, Romero-Lankao 2009). By reviewing the then recent literature, they identified core research challenges that they urged the future generation of scholarly inquirers to address.

The first challenge identified for future scholarship was to scrutinise, or at the very least to make visible, the gap between high levels of policy rhetoric on urban climate governance and the reality of limited activity on the ground. The second was to move beyond the cases from the Global North that at that time dominated the literature and the similarly dominant single-n and small-n studies. The third was to bring more coherence to the, at that time, fragmented and dispersed empirical knowledge base on how cities govern climate change action, particularly so that a better understanding could be gained as to what factors enable this. The fourth and final challenge was to gain insight into the outcomes of urban climate governance and into whether its accumulated effects had the desired global impact.

To gain an understanding of how our knowledge base has developed, this article takes stock of the urban climate governance scholarship that has emerged over the last ten years. It builds on a systematic review of 115 peer-reviewed journal articles and 145 books and book chapters published...
in English between 2009 and 2018. The review started in 2014, with a search on ISI Web of Science and GoogleScholar to capture publications using combinations of key words: adaptation, city, climate, climate change, governance, mitigation, resilience, resilient, sustainable, sustainability, and urban. This set was complemented with relevant publications cited in the publications traced (‘snowball sampling’). From 2014, this systematic and targeted search was repeated yearly until 2018 to capture novel publications in each year.

All 260 publications traced were read, and notes (including the key insights reported, the area of study, and the type of research project undertaken) were kept in a working document. This document was coded to capture the ‘repetitiveness’ and ‘rarity’ of themes and findings reported across the various publications (cf., Bearfield and Eller 2008, and Sutton, Papaioannou, and Booth 2016). The review that follows is structured by the four research challenges for urban climate governance scholarship that were identified by leading scholars at the end of the first decade of the twenty-first century. It begins, however, by setting the scene for those readers who are less familiar with the topic.

2 Cities and climate change: Well-trodden ground?
Is there anything we do not yet know about cities and climate change? Our ample access to staggering numbers means that it is not difficult to consider cities a key source of climate change (Gupta et al. 2015, Van der Heijden 2014, Washington 2015, Bulkeley et al. 2013, Sølecki et al. 2018). To mention a few of the relevant facts: whilst cities cover less than 5 per cent of the globe, it is estimated that some 70 per cent of global resources are consumed in cities, and that cities account for 70 per cent of global greenhouse gas emissions (UN 2016). Over 70 per cent of global GDP is generated in cities, and, with increasing urbanisation, cities can only be expected to become more dominant in the world economy (Sassen 2012). Over half of the world’s population already lives in cities, and this number is projected to grow to 70 per cent by 2050 (UN-HABITAT 2016). This latter projection may be particularly problematic, as it indicates that we will require even more or larger cities. Because urban lifestyles have been found to be considerably more resource-intensive than rural lifestyles (Bai, Shi, and Liu 2014), it may be expected that the negative impacts of cities will, therefore, grow exponentially rather than linearly (Rosenzweig et al. 2018, Sennet, Burdett, and Sassen 2018, Hall and Burdett 2017).

It is also not difficult to consider cities as key victims of climate change, as it is in cities that the effects of climate change will be experienced most severely by humans (Bulkeley 2013, Sanchez, Van der Heijden, and Osmond 2018, Tyler and Moench 2012, Coaffee and Lee 2016, Allen, Griffin, and Johnson 2017). Because of cities’ high population densities, their role in the global economy and in local economies, and their function as capital sinks, an event related to climate change will naturally have a major impact when it strikes a city (Dawson 2017). With most of the world’s cities, and particularly its larger cities, situated near the coast, sea-level rise related to climate change is now a major urban concern (Hallegratte et al. 2013). Moreover, what were formerly considered ‘freak events’, including extreme droughts affecting urban water supply, the flooding of cities due to extreme rainfall, and heatwaves with accompanying increases in urban mortality rates have, uncannily rapidly, become regular events (World Bank 2010). In addition, cities house concentrations of large groups of poor and marginalised people (Enright and Rossi 2018). These groups are particularly vulnerable to

1 A full list of these publications is available as online Appendix A: *insert hyperlink here*. The most common journals in the database are: Urban Affairs Review (8 publications), Local Environment and Energy and Buildings (both 5), Current Opinion in Environmental Sustainability (4), and Cities, Global Environmental Politics, International Journal of Urban and Regional Research, Journal of Cleaner Production, Journal of Urban Affairs, Nature, Transactions of the Institute of British Geographers, Urban Studies, and WIREs Climate Change (all 3). The most common publishers in the database are: Routledge (26 books and edited volumes), Palgrave (10), Springer (9), Cambridge University Press (4), and SAGE (3).
events related to climate change, because they tend to settle (or be settled) in the more vulnerable parts of cities, and they have less access to the societal safety nets that can be called on by more privileged citizens (Chu, Anguelovski, and Carmin 2016).

Another well-trodden path is to consider cities as particularly promising sites for climate action (LeGates and Stout 2011, Forman 2014, Acuto 2013, Mai and Fransesch-Huidobro 2015, Archer, Colenbrander, and Dodman 2017). A variety of cost-effective technologies is now available to reduce resource consumption – or even generate resources – at city level (Booth et al. 2010, Santamouris and Kolokosta 2016). Much progress has been made in understanding how to improve the behaviour of individuals, households and organisations and reduce their resource consumption and waste production – through regulatory, economic, or other nudge-type incentives (Van der Heijden 2014). It is expected that such technologies and behavioural interventions hold most promise in cities because of their relatively high densities and the possibilities of scaling up and scaling out niche interventions (Johnson, Toly, and Schroeder 2015, Sassen 2012). Taken together, these technologies and behavioural interventions may even result in regenerative cities – cities that create a net positive impact through urban development (Hes and Bush 2018). In addition, it is considered that the ease of collecting big data, improvements in big data analysis techniques, and advances in artificial intelligence can only further tap the potential of cities to reduce their negative impact on global climate change and make them more resilient to the negative consequences of climate change (Bibiri 2018). In sum, these three pathways were already well-trodden by 2009, and the review indicates that scholars and others are getting ever more support for the argument that cities matter in the global response to climate change.

3 Challenge 1: The gap between rhetoric and action

Besides these narratives of cities as cause, cities as victim, and cities as sites for climate action, a new narrative is on the rise. Polemicists, advocacy organisations and (local) government actors are actively driving a narrative of cities as saviours of the planet in the face of climate change (Newman, Beatley, and Boyer 2009, Barber 2013, Brescia and Marshall 2016, C40 and Arup 2017, Meyer 2013, Khanna 2011). This narrative considers cities as the essential link between the available solutions – technology and behavioural change – and climate action. Those driving this narrative borrow heavily from the scholarly literature to support their arguments of a global trend of urban climate action, and point at insights that cities often set higher climate governance ambitions than the nation states to which they belong (cf., Reckien et al. 2014), are involved in experiments with innovative urban governance interventions such as eco-financing and urban laboratories (cf., Karvonen and van Heur 2014), and have begun to break out of national–regional–local hierarchies and collaborate in trans-local and sometimes trans-national networks (cf., Acuto and Rayner 2016). In all of this, those driving this narrative are particularly critical of state-led regulatory interventions and are hopeful of bottom-up collaborations involving citizens, businesses, NGOs and local governments (e.g.,C40 and Arup 2017, ICLEI 2012, City of New York 2018, City of Amsterdam 2017, City of Sydney 2017).

It is not difficult to understand why the narrative of cities as saviours has great appeal. At its core it is an archetypal hero-story: a community (humanity at large, marginalised groups in specific cities, etc.) is threatened by evil (climate change), and existing institutions (nation states, established international non-governmental organisations, etc.) fail to deal with this threat; a selfless hero (a city government, a collective of mayors, a local grassroots organisation, etc.) rises, and through perseverance and ingenuity (innovative urban climate governance interventions, collaboration with others, etc.) it is able to overcome the threat (cf., Campbell 1949, Dundes 1984, Jewett and Lawrence 1977). This is a storyline that goes against many of the ‘doom and gloom’ narratives of climate change as an unsolvable, wicked, collective action problem, and because of its positivism in an area that is normally so negative, it is a story that sells (Hoffman 2011). However, the scholarly community is
critical of the sweeping claims made by polemists and advocacy organisations. They point out that it is all too easy to mistake (or selectively present) this quantitative evidence as a sign of a global tendency of cities to govern climate action, and, instead, they question how widespread the activity is (Johnson 2018, Van der Heijden 2017). Often, they find, climate change remains ungoverned in cities and, if it is addressed, it is a complement to, rather than a key topic in, urban governance (Bulkeley 2013, Heidrich et al. 2016, Shaw et al. 2016, Castán Broto 2017).

In sum, despite all the promising examples of governance for urban climate action presented in the ‘cities as saviour’ literature, for many cities around the globe traditional matters such as housing provision, sanitation and waste disposal are the more urgent areas for governance (Johnson, Toly, and Schroeder 2015, Rong 2010, Beermann et al. 2016, Van der Heijden 2016b). Also, the narrative of cities as saviours draws on a relatively small number of frontrunners in climate action, and not on the majority of cities and citizens around the globe. It reflects a ‘leadership delusion’ or ‘frontrunner paradox’, indicating a knowledge mismatch between what climate action frontrunners can achieve and what the average city and citizen are willing to accept and are capable of delivering (Van der Heijden 2017, 2018). This all indicates that the gap that was observed a decade ago between the high levels of policy rhetoric about urban climate governance and the reality of limited activity is still present. Having said that, the interest among cities in governing climate action is observed to be on the rise, partly driven by the developments of the 2015 Paris Agreement (Blok and Tschötschel 2016, Krause, Yi, and Feicock 2015, Romero-Lankao, Burch, and Hughes 2018, Reckien et al. 2014, Reckien et al. 2018).

4 Challenge 2: Beyond the Global North, beyond small-n studies

The second challenge identified a decade ago for urban climate governance scholarship was to move beyond studies of cities in the Global North (and predominantly in North America and Europe), and beyond small-n studies. To gain an understanding as to whether this challenge has been addressed, the set of 260 publications underlying this review was coded to gain an insight into: (1) the institutional location of the lead author, (2) the area of focus of the publication, (3) the type of study, (4) the scale of the focus of the publication, and (5) whether the article is an empirical study or a conceptual study.

Table 1 gives an overview of the coding outcomes.

Table 1 indicates that of the 260 publications analysed, 60% are empirical and present novel data or use existing data in a novel way. The remaining 40% are conceptual publications that use secondary data for illustrative purposes, or do not refer to any data at all. Generally, both the empirical publications and the conceptual publications are written by (lead) authors based at institutions in the Global North (86% for the full dataset). Of the empirical publications, approximately half build on data solely from the Global North (52%), a quarter on data solely from the Global South (25%), and the remainder on data from the Global North and South (24%). Of the conceptual publications, a minority have a sole focus on either the Global North (5%) or the Global South (3%), a quarter focus on the Global North and South (25%), and the vast majority (68%) do not have a specific geographical focus. Approximately half of the empirical publications address urban climate governance within a city (47%). This includes a focus on initiatives at neighbourhood or sub-city level, governance

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2 These data were further explored to identify scholars from Japan and the Four Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) that are normally included in the Global North. Of all the publications analysed, only 6% (n=16) of (lead) authors were identified as being based at institutions in these countries.

3 Again, these data were further explored to identify publications that solely focus on Japan and the Four Asian Tigers. Of all the publications analysed, only 4% (n=10) do.
interventions in a specific policy area (e.g., energy), and local initiatives driven by citizen action groups and businesses. A quarter of the empirical publications consider the urban climate governance of a city or cities as a whole (25%), and these mainly consider the role of local government in governing climate action. Of the remaining empirical publications, a minority address the supra-city level, including city networks (13%), and a minority do not address a specific level (15%). Of the conceptual publications, approximately a quarter touch on urban climate governance within a city (26%) and approximately a third on a city as a whole (30%), and a minority discuss the supra-city level (3%). The remaining conceptual publications (41%) do not address a specific level. Finally, most of the empirical papers are either single-n studies (30%) or small-n studies involving two to five cases or observations (41%). A minority of empirical papers is made up of medium-n studies involving six to thirty cases or observations (12%), or large-n studies (17%).

In sum, the challenge identified a decade ago still stands. The empirical urban climate governance literature is still dominated by studies (and scholars) from the Global North, and it is still dominated by single-n and small-n studies. In addition, the ‘count’ of empirical publications included in the review is slightly polluted by cases and data-points that feature in multiple publications. This holds particularly for single-n and small-n case studies using data from the Global South. When considering only unique cases and data-points – and not the number of publications building on them – the set of publications underlying the review is skewed even more strongly towards the Global North.

5 Challenge 3: Systematic analysis of enabling factors

The third challenge identified a decade ago for urban climate governance scholarship was to gain an understanding of the factors that enable cities – city governments and others – to govern local climate action effectively. The earlier reviews (e.g., Bulkeley 2010, Betsill and Bulkeley 2007, Sippel and Jenssen 2009, Romero-Lankao 2009) carefully concluded that some enabling factors were emerging in the literature, but the empirical base underlying these was thin. It is safe to say that considerable advances have been made in mapping, exploring and systematically analysing such enabling factors over the last decade. The 260 publications underlying the current review clearly identify a set of enabling factors as necessary (but not sufficient) for effective urban climate action. The most important of these are briefly introduced in what follows.\(^4\) It needs to be noted that there is some overlap between the different factors, or at least that their boundaries are blurred. Further, scholars point out that in real world settings the factors are often intertwined (Haus and Erling Klausen 2011, Bulkeley, Castán Broto, and Edwards 2015, Rosenzweig et al. 2018, Bernstein and Hoffmann 2018).

- **A supportive political and legal context:** The extent to which cities and those within them can govern climate action depends on, and is affected by, the regional and national political and legal context in which they are embedded (Pierre 2011, Johnson, Toly, and Schroeder 2015, Castán Broto 2017, Schroeder and Bulkeley 2009, Cadman, Maguire, and Sampford 2017). There is some evidence that cities are more likely to engage in urban climate governance in contexts that are supportive of climate action than in those that are not (Boswell and Mason 2018). Moreover, policy and other debates indicating a future implementation of climate policies, legislation and actions at regional or national levels may be an impetus for cities to develop their own urban climate governance interventions, processes and institutions (Jordan, Wurzel, and Zito 2005). However, the regional and national context can be supportive in other ways as well. For example, existing regional or national legislation may allow for local experimentation and provide sufficient niches in which cities may experiment (Wilkinson

\(^4\) It also needs to be noted that this set of conditions by no means captures *all* the enabling factors that have been identified in the urban climate governance literature.
Alternatively, a supportive context may provide the checks and balances to resist local actors when they betray their aims to achieve desirable climate action (Cadman, Maguire, and Sampford 2017). In these situations, the regional and legal context fulfils, at the very least, enforcement and oversight functions for urban climate governance interventions (Van der Heijden 2014).

- **Autonomy**: The effect to which cities and those within them can govern climate action also depends on their autonomy for taking urban climate action and governing local affairs (Johnson 2018, Hein and Pelliter 2006, Bulkeley and Betsill 2013). Put simply, if city governments and other local actors lack decision-making power in this area, it will be difficult for them to govern their ‘own’ urban climate actions (Romero-Lankao, Burch, and Hughes 2018). Across the world, urban politics are often a patchwork of obligations and responsibilities lying with national, regional and local authorities (Van der Heijden 2017). Within these patchworks, local governments have long been considered the executive branch of national governments, merely tasked with implementing national legislation and regulation and delivering public services (Pierre 2011). Nevertheless, processes of decentralisation, as well as privatisation of service delivery, have slowly given city governments more autonomy across a range of local policy areas, including climate change. This now often allows cities considerable autonomy for governing climate action in ways that are tailored to local circumstances but fall within the boundaries of a larger national climate change framework. Alternatively, national governments may neither have in place climate change policies or legislation nor restrict cities from acting in this area. This gives cities carte blanche to govern and implement local climate actions (Garvin 2014).

- **Access to funding for climate action**: The extent to which cities have access to funding for climate action is generally considered another condition that is relevant to urban climate governance (Hughes 2017, Bulkeley 2013, Sanchez-Rodriguez 2009, Hughes, Chu, and Mason 2018, Clarke 2017, Jupesta and Wakiyama 2016). National financial support for local initiatives is often limited, and cities generally cannot acquire money in the same ways as national governments: they lack creditworthiness in international financial markets, they do not have the authority to borrow funds independently, and they face restrictive requirements for bidding and procurement (Lall et al. 2013, Brugman 2012, Mori 2012). This gap is now being filled by other finance opportunities for cities, including public funding mechanisms such as the Green Climate Fund, national and regional development banks, and business finance (Rosenzweig et al. 2018, Chapter 7). In addition, cities have begun to search for creative solutions to fund their climate agendas, including revolving loan funds, property assessed financing, and green bonds (Van der Heijden 2016a). While these other means of financing are lauded for supporting cities in pursuing their climate agendas, concerns are also expressed about them. Seeking finance, cities may aggressively compete with each other, and over time this may reduce or erode the collaboration between them (Evans, Karvonen, and Raven 2016). Committing to external forms of funding implies that cities also make themselves subject to the requirements set, and possibly the political agendas pursued, by external funding suppliers (Davies and Imbroscio 2009). Finally, local government staff may lack the skills to acquire, manage and account for such novel means of finance (Van der Heijden 2014).

- **Vertical coordination**: While cities are widely considered capable of spurring on climate action in circumstances in which higher levels of government, and non-governmental organisations, have not (yet) achieved results, the broader urban climate governance literature understands that successful cities do not act in isolation. Being embedded in multi-level networks that ensure vertical coordination between a city government, the regional government, and the national government is considered key in creating a supportive context for urban governance.
for climate action (Knieling 2016, Kern and Mol 2013, Johnson, Toly, and Schroeder 2015, Luque-Ayala, Marvin, and Bulkeley 2018, Bulkeley et al. 2013, Hughes, Chu, and Mason 2018, Clarke 2017). Alternatively, an organisation may take up the role of vertical coordinator: for instance, a dedicated national government body may be installed to ‘orchestrate’ climate actions across and between different levels (Abbot, Genschel, and Snidal 2016, Bäckstrand and Jonathan 2017). It is then argued that climate action is linked to local, regional, national, and international actors and issues, and needs support from, and an understanding of, all these levels to be effective. Indeed, some research has pointed out that cities embedded in such multi-level governance systems or supported by dedicated coordinating organisations are more likely to govern climate action than those that are not (Homsey and Warner 2015).\(^5\)

- **Horizontal coordination:** In a similar vein, horizontal coordination is also considered a relevant condition in urban climate governance trajectories that spur on climate action. In particular, coordination across different departments, agencies and organisations within a city is considered to be relevant (Knieling 2016, Coaffee and Lee 2016). Examples such as central coordination of urban climate governance from the mayor’s office, or dedicated climate change agencies or working groups that bring together civil servants from different sectors, have been found to be helpful in the development of urban climate governance interventions, processes and institutions (Sanchez-Rodriguez 2009). By means of illustration, city departments responsible for technical aspects (waste collection, transport, etc.) are traditionally organised separately from city departments responsible for social aspects (education, employment, etc.). A dedicated climate action body, agency, or working group at city level may then help traditionally organised departments to break out of these siloes and achieve synergies across technological and societal transitions at city level (Lee 2018).

- **Being part of capacity-building and learning networks:** Much is also expected from cities’ participation in the vast number of city networks that have emerged since the early 1990s (Rosenzweig et al. 2018, Jordan and Turnpenny 2015, Acuto and Rayner 2016, Castán Broto 2017, Gordon 2016). Progressive cities in less progressive nations may find like-minded cities in more progressive nations through these networks, there is an abundance of information available for network members and non-members on network websites, and, by combining resources (funds, staff, and so on), these networks are capable of carrying out more rigorous climate governance experiments than cities can when they act alone (Bansard, Pattberg, and Widerberg 2017, Johnson, Toly, and Schroeder 2015, Barber 2013). Evidence has emerged that participation in city networks positively influences urban climate governance at city level (Heidrich et al. 2016). This much has been said in favour of such networks, but some researchers look critically upon cities that join networks, arguing that such cities may well seek to freeride on the good name of a large network, but not necessarily to commit themselves to the ambitions of that network (Jonas, Gibbs, and While 2011). Others have highlighted that these networks may easily become networks of pioneers for pioneers (Kern and Bulkeley 2009) and do not always pursue a desirable climate action agenda (Bansard, Pattberg, and Widerberg 2017), and that there is a risk of such networks becoming an end in themselves rather than being a means to an end (Johnson, Toly, and Schroeder 2015).

- **Collaboration with and participation of stakeholders:** It is generally considered that collaboration between governmental and non-governmental actors, and the participation of a wide range of stakeholders, will improve the outcomes of urban climate governance (Chu,

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\(^5\) This enabling factor is very much aligned with the first, ‘a supportive political and legal context’. However, a supportive context does not necessarily require that vertical forms of coordination have been institutionalised. Another term used for this enabling factor in the literature is ‘vertical integration’ (Gordon 2018).
Anguelovski, and Carmin 2016, Kwon, Jang, and Feicock 2014, Castán Broto and Bulkeley 2013, Coaffee and Lee 2016, Haus and Erling Klausen 2011, Hes and Bush 2018). Such co-governance processes are expected to help with the solution of policy problems that are too complex for an individual organisation to solve alone, to increase the transparency of decision-making, and to result in context-appropriate solutions (Sidiki et al. 2015). However, as with the other conditions, this one does not come without its critics. Not every form of collaboration and participation will give stakeholders a similar level of power to influence cities’ climate agendas and action (Sarzynski 2015). Collaborative and participatory processes run the risk of being hijacked by narrow and vested interests, may result in a further repression of already marginalised groups, and may not always align with the urgency of timely decision-making (Sprain 2016, Scott 2015, Birnbaum 2015, Knieling 2016, Pierre 2014). It is sometimes argued that such co-governance is a result of neo-liberal processes, austerity politics, and an idealised image of the active individual who works for the greater good of the community and has only purely altruistic motives (Enright and Rossi 2018, Ansell and Torfing 2015). The normative significance of collaboration and participation may then overshadow their possible undesired outcomes (Birnbaum 2015).

• **Presence of a local climate champion**: A final condition that consistently recurs in the literature is the presence of a local climate champion or entrepreneur. Mayors and other urban political leaders are often looked upon as precondition for effective urban climate governance (Gupta et al. 2015, Castán Broto 2017, Haus, Heinelt, and Stewart 2005, Hughes, Chu, and Mason 2018, Sanchez-Rodriguez 2009, Haus and Erling Klausen 2011). Vocal, charismatic, and experienced city leaders, in particular, may be able to find connections with other cities, and build networks that reach beyond national borders (Sassen 2012). The entrepreneurial spirit that they often show may then be essential in the development of urban governance for climate action (Kalafatis and Lemon 2017). While the idea that mayors and urban political leaders should ‘rule the world’ (Barber 2013) may be over-romanticised, there is some evidence that mayor-led city governments are more likely to be involved in urban governance for climate action than city governments that are not led by mayors (Krause 2011). That being said, the success or lack thereof of a mayor pursuing an ambitious, far-reaching, synergistic, congruent and courageous climate agenda may be very dependent on the other conditions she faces: if the city she spearheads is less institutionally fragmented, if it has stronger multi-level and horizontal coordination, and possibly if it is larger, then she will be more successful (Kalafatis and Lemon 2017).

The broad consensus in the literature is that these enabling factors work in conjunction, and that there are likely to be different trajectories or pathways of interacting factors that lead to effective urban climate governance (Haus and Erling Klausen 2011, Bulkeley, Castán Broto, and Edwards 2015, Luque-Ayala, Marvin, and Bulkeley 2018, Coaffee and Lee 2016, Bulkeley et al. 2013, Van der Dool et al. 2015, Campbell, Kim, and Eckerd 2015, Rosenzweig et al. 2018, Van der Heijden 2017).

6 **Challenge 4: Systematic analysis of governance outcomes**

The fourth and final challenge identified was to gain an understanding of the outcomes of urban climate governance, and of whether these outcomes add up to a desired global effect. Studying these outcomes is arguably one of the most daunting tasks. As was the case a decade ago, there is no single indicator (e.g., energy use, citizen engagement, or carbon emissions) that best captures the outcomes of effective urban climate governance (Sennet, Burdett, and Sassen 2018, Chan et al. 2018), and nor is there a single yardstick that is best for measuring these outcomes (Widerberg and Stripple 2016,
Johnson 2018, Ren 2013). Also, in studies of urban climate governance the object of study is often moving rapidly. This holds particularly for the studies on experimental and innovative forms of urban climate governance that are dominant in the sub-set of empirical ‘within city’ publications in the literature review. A central aspect of innovative and experimental urban climate governance interventions, processes and institutions is that they are changed in response to lessons learnt during their (initial) implementation (Wolfram et al. 2019). Tracing cause and effect relationships, or linking the outcomes observed to a specific form or stage of those interventions, processes or institutions, is then not at all easy. In addition, the outcomes of urban climate governance can often not be studied in isolation from other social phenomena, and are often not observable at the time of study or cannot be directly attributed to the governance (this is, of course, a core problem for many scholars of politics, policy and governance, Stone 2002, Bell and Hindmoor 2009, Chhotray and Stoker 2010).

Despite these challenges, scholars have made exceptional progress in systematically analysing the outcomes of urban climate governance. For example, researchers at University College London have measured the impact of city networks on overall city emissions (C40 Cities, Arup, and University College London 2015). Researchers at Yale University have measured the actual and potential impact of city commitments and actions (Hsu et al. 2018). A collaborative of researchers from Canadian universities has evaluated the impact of climate governance by non-state and sub-national actors (including cities), using a set of leading indicators for transformative change (Van der Ven, Bernstein, and Hoffmann 2017). Finally, a collaborative of researchers from European universities has applied the ‘function–output fit’ method to assess whether climate actions by non-state actors (including cities) produce outputs that are consistent with their main functions (Chan et al. 2018). When looking across these research projects, however, it appears that, collectively, cities are not yet on the necessary pathways to help to curb climate change globally. Scholars are also active in urban living labs and similar ‘controlled experimental’ settings of urban climate governance (Dell’Era and Landoni 2014, Voytenko et al. 2016, Schuurman, De Marez, and Ballon 2016), and have begun to embrace participatory action research (Burch et al. 2015, Cloutier et al. 2015) to gain a better insight into the cause and effect relationships of urban climate governance.

Here it is worth mentioning that, for complex, high-level indicators, such as climate justice, scholars sometimes work with more specific attributes as proxies of building block when assessing (in the ‘best approximation sense’) the outcomes of urban climate governance (Rosenzweig et al. 2018, Matthew et al. 2018, Aiken et al. 2017, Coaffee and Lee 2016). For example, the observation that a governance intervention has helped to rebalance the unequal sharing of the burden of climate risks amongst different groups (McKendry 2018) may provide the basis for a measure of overall climate justice—even though the burden sharing is a building block of climate justice and not in itself a direct measure of it. In similar vein, to assess a city’s ‘true commitment’ to climate action a researcher may wish to focus on the level of congruence between stated commitments and allocated resources—the level of congruence then acts as a proxy for measuring commitment. Indicators of high congruence could be the budget and staff allocated to implement governance interventions, or the dedicated processes that are in place for governance evaluation and learning (Cadman, Maguire, and Sampford 2017, Chan et al. 2018). Another alternative is assessing the indicators a vector, to gain insight in direction, speed and magnitude rather than an exact state of affairs. For example, in a research project interested in ‘true sharing of power’ it will be difficult to assess the exact amount of power held by different agents. It may be possible, however, to measure different proxies for ‘power’ and from these

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6 Goals specified in international agreements such the Paris Agreement (UN 2015a), the Sustainable Development Goals (UNDP 2015), or the Sendai Framework for Disaster Risk Reduction (UN 2015b) may provide starting points, but they also face criticism for not being ambitious enough (Rogelj et al. 2016) or for stating goals that are simply unachievable within the opportunities and constraints faced by many cities (cf., Bulkeley et al. 2013, Luque-Ayala, Marvin, and Bulkeley 2018).
distil the direction and speed of power sharing between the governing agents and those who are governed (Enright and Rossi 2018).

7 Discussion and conclusion: Research challenges for the next decade

This article set out to review a large body of urban climate governance scholarship published between 2009 and 2018. It has done so informed by four core research challenges for this field of scholarship that were pointed out by leading academics about a decade ago. When stepping back to assess how much our knowledge of urban climate governance has improved over the last decade, a critical observer and a more moderate one may draw different conclusions. The critical observer would argue that, despite a rapid growth in the urban climate governance literature, our knowledge of this field is still piecemeal and dispersed, as it was a decade ago. Knowledge from cities in the Global South (but also from smaller cities in the Global North) is still lacking, and there still is a lack of medium-n and large-n studies in this scholarship. The critical observer would add that our current knowledge base is skewed because of an overrepresentation in studies of urban climate governance of a handful of large and highly active cities in the Global North, and because of an overrepresentation of ‘success’ cases at the expense of ordinary or even failing examples of urban climate governance. The moderate observer would point out that great advances have been made in understanding what factors contribute to effective urban climate governance, and that the potential for cities to respond to climate change has become ever more visible through, among other things, research projects that are interested in the outcomes of urban climate governance. For the moderate observer, the partial and limited evidence base does not overshadow the relevance of the findings and the conclusions reached, because it provides many starting points for future research, such as an assessment of the reach of findings and conclusions across a range of yet un(der)explored geographies.

Both the critical and the moderate observer would agree, however, that there are demanding research challenges for the next decade of urban climate governance scholarship. Obviously, those identified a decade ago are still present. It is essential to remain critical of the gap between policy rhetoric and action on the ground, to open our research lenses to understudied areas in urban climate governance, and to expand the number of systematic medium-n and large-n studies. Another challenge is for scholars to gain a better understanding of the various pathways that may lead to effective urban climate governance. Scholars repeatedly stress that there is no single (‘best practice’) route to the low-carbon, climate-resilient or climate-just city, and that there are potentially many pathways for governing urban climate transitions. What these pathways look like in reality remains in question. It also remains in question whether they unfold in specific patterns and can be managed, or whether they unfold in a messy manner and are unmanageable (Bulkeley et al. 2013). Analytical techniques such as process tracing, Qualitative Comparative Analysis (QCA), cluster analysis, and regression analysis may help to trace the pathways of interacting enabling factors, and the relationships between these factors and the outcomes in observed examples of urban climate governance. This may help, for example, in identifying essential configurations (small clusters of factors) that hold across a range of geographies, or, instead, different context-specific pathways for effective urban climate governance across world regions (cf., Rihoux and Ragin 2009, Bennett and Checkel 2015, Van der Heijden 2017).

It is also essential to scrutinise the explanatory reach of the accumulated knowledge base. For example, the set of enabling factors identified over the last decade may – and, most likely, will – be the starting point for studies that criticise this set for being too limited for a full understanding of real-world examples of urban climate governance and its outcomes. Research projects building on an inductive logic will help to enrich this set, for example through analytical techniques such as the Gioia methodology – a systematic approach to new concept development (Gioia, Corley, and Hamilton 2012). At the same time, the set of factors may serve as the basis for research projects building on
abductive logic, and analytical techniques such as grounded theory and adaptive theory may be applied. Here these enabling factors may provide a starting point for, but not set the boundaries to, research projects that are interested in finding social patterns and structures in urban climate governance (cf., Birks and Mills 2015, Layder 2006). It is equally important to create a stronger connection between knowledge on urban climate governance and the theoretical frameworks that are central to urban studies, governance studies, international relations, and other related fields. This could be done by taking, as the starting point for a new study, a theoretical framework such as social psychology (cf., Ljungkvist 2015), Foucauldian governmentality theory (cf., Bulkeley 2012), Actor-Network Theory (cf., Acuto 2013), or Castell’s network theory (cf., Bouteligier 2013) to understand, for example, how power shapes, enables, and constrains the terrain on which cities engage in climate governance at both global and local scales (cf., Gordon 2018). Alternatively, scholars may wish to synthesise the existing knowledge base through the lenses provided by these theories, and deepen our understanding of themes such as agency, empowerment, and political contestation in urban climate governance (cf., Van der Heijden, Bulkeley, and Certomá in press).

Last but not least, a final set of core challenges is to understand whether and how promising examples of urban climate governance can be scaled up; whether and how synergies can be created between interventions, processes and institutions so that the whole of their impacts is larger than the sum of their parts; and how we can ensure that the progress made so far is not reversed by future swings in political leadership. Theories of large scale collective action indicate that scaling can occur in at least two directions: horizontal (or scaling out) and vertical (or scaling up or down) (Ostrom 2010, Hamilton et al. 2014). Combined with theories of governance, different scaling trajectories can be hypothesised – for example, ‘mandatory vertical scaling’ or ‘voluntary horizontal scaling’ – and studied in a comparative way to understand which scaling pathways are most promising, in which contexts, and why. Synergies may be sought between, for example, adaptation and mitigation actions (Coaffee and Lee 2016), or between technological and societal transitions at the city level (Johnson 2018). Theories of policy design indicate, however, that such synergies are unlikely to emerge spontaneously and must instead be designed deliberately (Howlett 2011, Jordan and Turnpenny 2015). These theories also warn that the promising urban climate governance interventions, processes and institutions of today may, if they are not sufficiently ‘sticky’, easily be reversed by future policy leaders or coalitions who are sceptical about climate change and the need to act in response to it. Various strategies have been suggested to achieve synergies and entrenchment – such as two-way interactions, functional overlap, and temporal calibration between governance instruments (Trencher and Van der Heijden in press, Bernstein and Hoffmann 2018) – and future scholarship may wish to gain a deeper understanding of which design and implementation strategies are effective for achieving synergies in, and entrenchment of, urban climate governance.

To conclude, important advances have been made in urban climate governance scholarship over the last decade. This scholarship was greatly supported by a sound foundation of research published by the end of the first decade of the twenty-first century. We now have an even stronger base to continue our research in this important area of growth, and we are faced with a number of challenging research questions that will no doubt generate important insights in the critical decade that lies ahead of us.
Tables
Table 1 – Quantitative analysis of 260 publications (2009-2018)*

|                              | Empirical publications (60%, n=155) | Conceptual publications (40%, n=105) |
|------------------------------|-------------------------------------|-------------------------------------|
| Author geographical background |                                     |                                     |
| Global North                 | 88% (n=137)                         | 98% (n=102)                         |
| Global South                 | 12% (n=18)                          | 2% (n=3)                            |
| Publication geographical focus |                                    |                                     |
| Global North                 | 52% (n=80)                          | 5% (n=5)                            |
| Global South                 | 25% (n=38)                          | 3% (n=3)                            |
| Global                       | 24% (n=37)                          | 25% (n=26)                          |
| None specific                | N/A                                 | 68% (n=71)                          |
| Publication scale focus      |                                    |                                     |
| Within city                  | 47% (n=73)                          | 26% (n=27)                          |
| Whole of city                | 25% (n=39)                          | 30% (n=31)                          |
| Supra city (including city networks) | 13% (n=20) | 3% (n=3) |
| Other                        | 15% (n=23)                          | 41% (n=44)                          |
| Type of study                |                                     |                                     |
| Single-n (1 case or observation) | 30% (n=47)                      | N/A                                 |
| Small-n (2 to 5 cases or observations) | 41% (n=64)         | N/A                                 |
| Medium-n (6 to 30 cases or observations) | 12% (n=18)    | N/A                                 |
| Large-n (31 cases or observations and up) | 17% (n=26)   | N/A                                 |

* Percentages do not always add up to 100% because of rounding.

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