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Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change

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Abstract

Cities around the world are garnering attention for their action to mitigate greenhouse gas emissions. Despite the proliferation of urban climate plans and mitigation commitments, the science is uncertain on whether these efforts will have an impact on global climate change. This is especially salient for urban areas in Asia and Africa, where most future urbanization and emissions growth are expected to occur. This paper explores the mitigation potential of cities and city climate networks, and provides an overview on how urban climate actions relate to ongoing national and international policy processes.

Introduction

In recent years, a focus on urban areas as key drivers of greenhouse gas emissions has led to a 'cottage industry' of frameworks and tools to measure and account for the impact of urban areas on climate change. Urban areas have become increasingly important units of environment and development policy in the international context through ongoing processes including the United Nations Sustainable Development Goals (SDGs), international climate negotiations (UNFCCC[2]), and the global conference on human settlements (Habitat III). The proposed SDGs, for example, have a stand-alone goal on cities, although exactly what indicators and performance targets will be used to track progress is still open for negotiation (UNCSD, 2014).

The increasing attention on cities as sites of opportunity and challenge to combat climate change corresponds with growing inertia in international negotiations. Cities, states, and private-sector organizations are new actors being discussed for their potential to fill leadership voids left in the absence of national action (Hsu et al., 2015; Biermann, 2012; Keohane and Victor, 2011; Pattberg and Stripple, 2008; Betsill and Bulkeley, 2007). Some scholars suggest that the growth in participation of subnational and nonstate actors is due to the fact that they are better positioned or willing to commit to more ambitious climate policies than national governments (Widerberg and Pattberg, 2014).

Scholars emphasize that cities have the right mix of authority and flexibility to experiment and innovate on "wicked problems" like climate change (Bulkeley and Castan Broto, 2013). Urban decision-makers are often directly elected, strengthening their means of authority and accountability, and cities provide the ideal setting for climate experiments lead by a diversity of city actors (Castan Broto and Bulkeley, 2013). The increasing number of cities that have taken voluntary measures to reduce greenhouse gas (GHG) emissions, many as part of regional or international city networks (Kern and Bulkeley, 2009; Krause, 2011), demonstrate these characteristics. Mayor Bill de Blasio of New York City, for example, has set an ambitious target to reduce greenhouse gas emissions 80 percent below 2005 levels by 2050 (OneNYC, 2014) – a goal heralded by environmental advocates as potentially the "most far-reaching one of its kind" (Flegenheimer, 2014).

For all these reasons and more, there have been increased efforts by academics, city networks, and multilateral institutions to measure how cities and urbanization processes contribute to global climate change. This paper explores the latest scientific research on aggregating urban emissions at the global scale to better understand the mitigation potential of cities as they relate to ongoing efforts of urban climate networks and international climate negotiations.

Measuring urban contributions to global climate change

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[2] United Nations Framework Convention on Climate Change (UNFCCC: http://unfccc.int/2860.php).

The difference in accounting methods – how urban boundaries, scopes, and calculation methods are selected – informs baselines for measuring and aggregating the impact of climate actions. Accounting for urban contributions to global climate change can vary depending on "scope" boundaries (e.g. direct vs. indirect emissions) set by greenhouse gas accounting protocols and also the physical boundaries of urban areas themselves. The International Panel on Climate Change (IPCC) states that "Urban areas account for between 71% and 76% of CO_2 emissions from global final energy use and between 67%-76% of global energy use [medium evidence, medium agreement]" (2014). These numbers depend highly on the "spatial and functional boundary definitions" as well the accounting methodology (IPCC, 2014) and particularly the attribution of Scope 3 or indirect emissions.[3]

Alternative accounting methods reveal different narratives to explain urban emissions patterns and drivers. Hybrid accounting, for example, seeks to combine production and consumption data to better capture different energy demands on the demand and supply sides (Ramaswami et al., 2012; Ramaswami et al., 2011; Ramaswami et al., 2008). Other scholars look at the allocation of greenhouse gases per capita in cities and find that affluence, as it relates to lifestyle and consumption patterns, is a key driver of urban emissions (Dodman, 2009; Satterthwaite, 2008). The correlation between affluence, urban density, and per capita emissions, however, varies across nations and within cities. The per capita emissions in many developed nations are lower on average in cities. In developing and emerging economy countries, such as China in the case of Beijing and Shanghai, urban dwellers have higher than national per capita emission, because cities are hubs of manufacturing and industry.

How city emissions are measured (by sector, scope, per capita, socioeconomics, etc.) informs the shape and direction of climate policy action. The lack of standardization in accounting methods has made it difficult to provide accurate estimates of the impact of city actions globally (IPCC, 2014). The voluntary nature of existing emissions reporting programs means that cities are encouraged to disclose their emissions, but not required to report many details of inventories, boundaries, baselines, and methods.

Adding up urban mitigation actions

Recent efforts to standardize accounting methods include the *Global Protocol for Community-Scale Greenhouse Gas Inventories* (GPC), a project lead by World Resources Institute, C40 Cities Climate Leadership Group (C40), and ICLEI - Local Governments for Sustainability (GPC, 2014). The C40 websites claim that partner cities have committed to over 8,000 climate actions, but how do these actions translate to tangible mitigation results?

Efforts are underway to count and aggregate the impact of city mitigation commitments. A report by Arup and C40 provides a methodology to aggregate emissions of 228 cities (over 400 million people) and estimates that city actions could reduce emissions by 13GtCO_2e against the business as usual scenario by 2050 (Arup and C40, 2014). At the historic 2014 United Nations Climate Summit in New York City, a coalition of the city networks and their members, including C40 and ICLEI, announced the Compact of Mayors to establish ambitious voluntary emission reduction targets using the GPC methodology, report progress towards those goals to the Carbon*n* Climate Registry, and make data transparent and readily available. Bloomberg Philanthropies, along with C40, estimated that in total, the Compact of Mayors could result in an offset of 454 million tons of CO_2 by 2020, which Hsu et al. (2015) estimate to be additional to existing national pledges. Their estimate includes three major urban sources of emissions: waste, buildings, and transport. Out of the 2,000-some cities in the Compact of Mayors, however, only 200 have specific emission reduction targets and mitigation plans.

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[3] Definition of GHG emissions "scopes" according to the U.S. Environmental Protection Agency: *Scope 1* includes direct GHG emissions owned or controlled by the entity; *Scope 2* includes indirect emissions from consumption of purchased electricity, heat, or steam; and, *Scope 3* includes indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities (http://www.epa.gov/greeningepa/ghg/).

Many of the programs and networks discussed above require cities to develop city climate action plans, but the IPCC concludes that these "targets are often arbitrary and aspirational, neither reflecting mitigation potential nor implementation" (2014). Even in the case of New York City's ambitious commitments, there is a question of how plans translate into actions over time. For instance, New York City mayors can serve up to two terms (four years each), so how likely is it that Mayor de Blasio can ensure follow-through for PlaNYC's 2050 goal? In fact, mayoral cycles and terms vary widely around the world, even within the U.S. In Boston, for instance, terms are also four years, but there are no terms limits (former Mayor Menino served five terms). The IPCC finds that targets in city climate plans are often framed in absolute emissions reductions and many developing country cities do not even include targets (IPCC 2014). As a result, it is difficult to assess and measure the diversity of plans and actions taking place.

Conclusions and Next Steps

While mayors, often as part of regional or international city networks, are increasingly making mitigation commitments, part of the challenge is aligning city actions with state and national policies. *The Power to Act* (2014), a report by C40, highlights both the opportunities and the limits to authority that mayors have over key sectors related to GHG emissions. Scholars discuss the complexity of city climate change issues as tied to forces beyond what is considered "urban," and suggest that emerging transnational networks challenge the traditional boundaries of local, regional, and state governments as well as the structure of environmental politics (Bulkeley and Betsill, 2005).

At the nineteenth UNFCCC Conference of the Parties (COP 19) in Warsaw, Poland, city climate networks, along with UN-Habitat,[4] organized the first 'Cities Day' to feature the work of cities on climate change. The goal of these efforts was to incorporate direct language about the role of cities, and the need for national climate policies to reference and support subnational climate action, into the negotiating text. This language was removed in COP 19, but during the following year in Lima, Peru (COP 20), the creation of the Non-State Actor Zone for Climate Action (NAZCA) platform[5] revived the more formal inclusion of non-state actions. The NAZCA platform aggregates ongoing climate action from cities (along with other nonstate and subnational actors) in attempt to showcase and support ambitious action of mayors and city networks[6] over the last few years. By highlighting this rise in city-level action, the platform also aims to demonstrate and build support for the possibility of more ambitious action at the national level, and of closer links between international and city actions.

As Paris 2015 (COP 21) approaches, how will nonstate actions be included in the final agreement, national commitments, and financial arrangements? To date, Intended Nationally Determined Contributions (INDCs) do not mention cities or urban areas (with the exceptions of Mexico and Gabon)[7] and commitments are aggregated at the national level. Without disaggregated targets at either the sector or jurisdictional levels, accounting for overlaps between national and city-level pledges to understand where subnational efforts are additional is challenging. It is too early to see how cities will ultimately feature in the Paris Agreement. Below are some considerations for how the upcoming negotiations and those working on urban climate change might ramp-up the potential of city actions to mitigate global climate change:

Including the cities yet to be built. To fully understand how the diversity of urban growth patterns contribute to climate change and to determine pathways for low-carbon growth, more research is needed in the area of

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[4] United Nations Human Settlements Programme (UN-Habitat: http://unhabitat.org/).

[5] Non-State Actor Zone for Climate Action platform (NAZCA: http://climateaction.unfccc.int/).

[6] Compact of Mayors (2014), U.S. Mayors Climate Protection Agreement (2005), the EU Covenant of Mayors (2008), Making Cities Resilient Campaign (2010), the Global Cities Covenant on Climate – the Mexico City Pact (2010), and the Durban Adaptation Charter (2011).

[7] INDCs submitted online to the UNFCCC as of 20 May 2015 (http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx).

growing and emerging urban areas (IPCC, 2014). The majority of urban areas have yet to be built and construction materials alone are projected to produce 470 Gt of CO_2 emissions (IPCC, 2014), even without accounting for the energy costs of building and maintenance. Although the majority of this growth will occur in developing countries, current research on the link between urbanization and climate forcing factors is biased towards developed cities and countries. Furthermore, there is a lack of data on small and medium cities, where much of urbanization is expected to occur (Seto et al., 2012). These are also the parts of the world with the greatest "knowledge deficits" and data gaps, so it makes understanding their emissions growth even harder and more important.

Measuring across and within cities. Although the standardization of accounting standards is allowing for more comparable data, the GPC guidelines make the inclusion of Scope 3 (or Basic+) activities voluntary. The parameters for defining production- versus consumption-based activities in the energy supply chains greatly influences how policy is designed to change infrastructure and/or behavior. Different accounting methods can reveal alternate mechanisms to reducing emissions. For example, a supply side strategy might incentivize suppliers to adopt low-carbon technology or increase their clean energy mix, while a demand side strategy might encourage energy efficient appliances or price-based mechanisms to influence consumer behavior. This distinction is especially important when it comes to questions of climate justice and determining who should take responsibility to implement and finance climate actions. In the case of cities, where the rich and poor live side by side, the question of equity across and within cities is especially complex.

Linking national, regional, and city climate planning and finance. The IPCC states that land use planning is one of the most underutilized tools for mitigation potential (2014). Accounting for land-based emissions is also a source of great uncertainty in INDCs (Levin et al., 2015). In many ways, climate planning in cities highlights the importance of cross-sector approaches, but national climate planning is often economy-wide and sector-specific. A more holistic understanding of urbanization processes is needed to understand how various development factors relate (Solecki et al., 2013) to avoid maladaptation and centuries of lock-in from poor infrastructure planning (Seto and Shepherd, 2009). The intersection of land use planning and transportation is a good opportunity for integrated climate planning that links from the city to regional and national scales.

Cities' mitigation commitments, as well as their efforts to foster and plan for adaptation and resilience, are gaining momentum worldwide. It is important, however, that national and international processes align with, and do not hamper, the flexibility of cities to make ambitious plans and to experiment with climate solutions. Cities are not all the same, and the diversity of 'urban areas' necessitates a wide range of actions and approaches. The success of the urban climate agenda to infuse stalled international negotiations with much needed ambition is a step forward towards a global agreement – now it is critical to make sure that new cities are included, and that the numbers add up.

References

Arup and C40. 2014. Global Aggregation of City Climate Commitments. Available online: http://publications.arup.com/Publications/G/Global_Aggregation_of_City_Climate_Commitments.aspx.

Betsill, Michele M. and Harriet Bulkeley. 2007. "Looking Back and Thinking Ahead: A Decade of Cities and Climate Change Research, Local Environment." *The International Journal of Justice and Sustainability*, 12 (5): 447-456.

Biermann, F. 2012. The overall effects of partnerships for sustainable development: more smoke than fire?, in Pattberg et al. (eds.), Public-private partnerships for sustainable development: emergence, influence and legitimacy, Cheltenham, UK: Edward Elgar. 69-87.

Bulkeley, H and Vanesa Castán Broto. 2012. “Government by experiment? Global cities and the governing of climate change.” *Transactions of the Institute of British Geographers*, 38 (3): 361-375.

Bulkeley, Harriet and Michele Betsill. 2005. “Rethinking Sustainable Cities: Multilevel Governance and the 'Urban' Politics of Climate Change.” *Environmental Politics*, 14(1): 42-63.

C40 Cities Climate Leadership Group (C40). 2014. *C40 Cities: The Power to Act*. Available online: http://c40-production-images.s3.amazonaws.com/researches/images/19_C40_Climate_Action_Report.original.pdf?1391555377.

Castán Broto, Vanesa and Harriet Bulkeley. 2013. “A survey of urban climate change experiments in 100 cities.” *Global Environmental Change*. 23(1): 92–102.

Dodman, D. 2009. Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories. *Environment and Urbanization*, 21(1): 185 –201.

Flegenheimer, M. (2014). De Blasio Orders a Greener City, Setting Goals for Energy Efficiency of Buildings. The New York Times. 20 Sept. Available online: http://www.nytimes.com/2014/09/21/nyregion/new-york-city-plans-major-energy-efficiency-improvements-in-its-buildings.html?_r=0.

Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). 2014. Greenhouse Gas Protocol. Available online: http://ghgprotocol.org/files/ghgp/GHGP_GPC.pdf.

Hsu, Angel, Andrew S. Moffat, Amy J. Weinfurter. Jason D. Schwartz. 2015. “Towards a new climate diplomacy.” *Nature Climate Change*. 5:501–503.

International Panel on Climate Change (IPCC). 2014. Seto K.C., S. Dhakal, A. Bigio, H. Blanco, G.C. Delgado, D. Dewar, L. Huang, A. Inaba, A. Kansal, S. Lwasa, J.E. McMahon, D.B. Müller, J. Murakami, H. Nagendra, and A. Ramaswami, 2014: Human Settlements, Infrastructure and Spatial Planning. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Levin, Kelly, David Rich, Jared Finnegan, Pedro Martins Barata, Yamide Dagnet and Kati Kulovesi. 2015. Accounting framework for the Post-2020 period. Nordic Council of Ministers. Available online: http://norden.diva-portal.org/smash/get/diva2:799242/FULLTEXT01.pdf.

Keohane, R. O., & Victor, D. G. 2011. The regime complex for climate change. *Perspectives on politics*, 9(1): 7-23.

Kern, K. and Bulkeley H. 2009. “Cities, Europeanization and Multi-level Governance: Governing Climate Change through Transnational Municipal Networks.” *JCMS: Journal of Common Market Studies*, 47: 309–332.

Krause, Rachel M. 2011. "Symbolic or Substantive Policy? Measuring the Extent of Local Commitment to Climate Protection" *Environment and Planning C: Government and Policy* 29.1: 46-62.

OneNYC. (2014). One New York, The Plan for a Strong and Just City. Office of NYC Mayor Bill de Blasio. Available online: http://www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf.

Pattberg, Philipp and Johannes Stripple. 2008. "Beyond the Public and Private Divide: Remapping Transnational Climate Governance in the 21st Century", *International Environmental Agreements*, 8(4): 367-388.

Ramaswami, A., Weible, C., Main, D., Heikkila, T., Siddiki, S., Duvall, A., Pattison, A. and Bernard, M. 2012. "A Social-Ecological-Infrastructural Systems Framework for Interdisciplinary Study of Sustainable City Systems." *Journal of Industrial Ecology*, 16: 801–813.

Ramaswami, A., A. Chavez, J. Ewing Thiel, and K. E. Reeve. 2011. "Two approaches to greenhouse gas emissions foot-printing at the city scale." *Environmental Science & Technology*, 45(10): 4205–4206.

Ramaswami, A., Tim Hillman, B. Janson, M. Reiner, et al. 2008. "A Demand-Centered, Hybrid Life-Cycle Methodology for City-Scale Greenhouse Gas Inventories." *Environmental Science & Technology,* 42(17): 6455–6461.

Satterthwaite, David. 2008. "Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions." *Environment and Urbanization,* 20(2): 539–549.

Seto, Karen. C., Güneralp, B., & Hutyra, L. R. 2012. "Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools." *Proceedings of the National Academy of Sciences*, 1–6.

Seto, Karen C., and J. M. Shepherd. 2009. "Global urban land-use trends and climate impacts." *Current Opinion in Environmental Sustainability,* 1(1): 89–95.

Solecki, William, Karen C. Seto & Peter J. Marcotullio. 2013. "It's Time for an Urbanization Science." *Environment: Science and Policy for Sustainable Development*, 55(1): 12-17.

United Nations Commission on Sustainable Development (UNCSD). 2014. Open Working Group proposal for Sustainable Development Goals. Available online: https://sustainabledevelopment.un.org/sdgsproposal.

Widerberg, O. and Pattberg, P. 2015. "International Cooperative Initiatives in Global Climate Governance: Raising the Ambition Level or Delegitimizing the UNFCCC?" *Global Policy*, 6: 5–56.