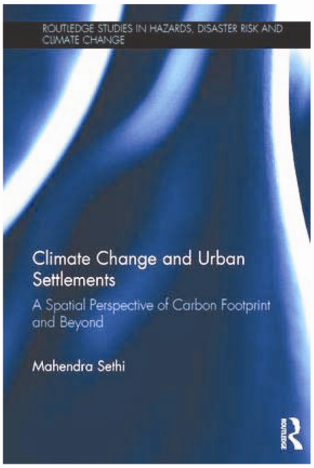

Climate Change and Urban Settlements: A Spatial Perspective of Carbon Footprint and Beyond. Mahendra Sethi. Routledge, Oxon, New York, USA, 2017. xxiii + 230 pages. Price: £107.00.

Climate change is now an enduring reality of our life time, an unquestionable fact to which this journal has unequivocally spoken about. With ever-changing climate dynamics, it is expected that climate science keeps up with highly focused and relevant research on the varying impacts and causes of climate change in different geographical and national situations. It goes without saying that developed countries are far ahead in providing research infrastructure and finance on climate science. Current research needs to timely and accurately report on progress made against Nationally Determined Contributions (NDCs) committed by countries, in addition to recognizing the special needs and challenges of developing countries that are vulnerable to climate risks and face growing pressures of economic and physical development, that is bound to increase their greenhouse gas emissions (GHGs). For instance, the recently released The Emission Gap 2017 Report, attributes the highest increase in emissions during 1971–2015 to India (followed closely by China), thereby mounting international pressure on India to deliver beyond its NDCs, totally dismissing historic (pre-1971) GHG emissions and adaptation needs.

This mandates a paradigm shift in how scientists and researchers conceptualize the estimation and contribution of GHG emissions to climate change, from a totally sector-wise and process-flow perspective, as conventionally done by input–output analysis and life cycle assessments to a more systemic and spatial perspective, whereby different sources of emissions and their drivers are considered from a particular territory in an integrated manner. This territory could be a state, region or a settlement which could then be made more accountable within the prevailing governance frameworks. Could urban settlements that are at the bottom of the administrative pyramid be game changers? This conundrum started gaining widespread recognition and interest post-2009, when the world became more urban than rural, for the first time in the history of mankind. UN-Habitat (2011) famously stated that, 'climate change and urbanization are two of the greatest challenges currently facing humanity in the 21st century, whose effects are converging in dangerous ways'. The release of three reports one after the other by leading organizations – Organisation for Economic Co-operation and Development (OECD), the World Bank, and UN-Habitat – set the arena for a new research agenda. These were instrumental in underpinning that cities contribute to climate change, and simultaneously get affected by it, thus seeking a more nuanced and methodical understanding in this interdisciplinary area.

As the world industrializes and urbanizes in the 21st century (UN reports that by 2050, seven out of ten people will live in urban areas), the situation can become even more critical, particularly for the developing countries. On the contrary, environmental discourse in many of these countries like India, China, Indonesia, South Africa, etc. due to enduring pressures of development and international positioning at the UNFCCC negotiations, has largely been driven by denial and defiance, thus limiting their responsibilities of the global carbon footprint burden. While there is growing policy study and grey literature interlinking climate change with urbanization, it lacks sufficient scientific approach and empirical rigour to support development alternatives. These complexities and contradictions in scientific and policy exchange called for a systematic and empirical investigation into how carbon footprints function as the world further urbanizes, at different spatial units – global, national and local city level. In this respect, the book under review is released at a very opportune moment, addressing some of these research and application based issues head-on.

While undergoing study of the relevant literature, the author suitably posits this research at the confluence of four major knowledge gaps: conceptual gap, empirical gap, methodological gap and policy-governance gap. Accordingly, conceptual gap arises from the group of issues that inhibit a clear theoretical understanding of how nations, settlements or societies when develop and urbanize influence their carbon footprint. Empirical gap comes from either lack of sufficient scientific causations about urban carbon footprints or evidential data to support the prevailing theoretical knowledge. Methodological gap is caused by a gamut of reasons that inhibit proper assessment of a city's footprint. Policy-governance *gap* is a consequence of limited knowledge with cities about their roles and responsibilities to effectively respond and act for greener pathways. These gaps lead to framing of three basic research questions: (1) How do countries in different states of development – economic and urban/rural – exhibit diverse patterns of GHG emissions? (2) What is the cumulative GHG responsibility or carbon footprint of urban areas within a country? (3) How do cities with different spatial dispositions affect their GHG emissions?

The book has six chapters. The first chapter, Climate change and urban areas, introduces these two evolving global phenomena underlining new evidence and research. The chapter builds on credible research of IPCC, UN-Habitat, and other peer-reviewed literature to underscore some of the most critical intervening gaps (discussed above), while setting the research objective and research plan for a more meticulous investigation, building the case of developing countries like India that aptly represent the challenges of global warming and urbanization. The second chapter takes this strand forward to empirically establish the interrelation between development, urbanization and carbon footprint. In the process, this research generates a 3×3 spatial development matrix to analyse, probably for the first time ever, inequities in urban, economic, energy and GHG profiles of over 200 countries, superimposing data sets from the UN, World Bank, Carbon Dioxide Information Analysis Centre (CDIAC) and International Energy Agency (IEA). The results

are confounding that, on the one hand, question the traditional duality between the Global North and South and, on the other, indicate sustained urban–rural disparity in addition to several other emerging patterns. The chapter ends by forming superimposed time-series scenarios for India that clearly demonstrate that all the trends are escalating in tandem, calling for an urgency to battle global warming. It also infers that uncontrolled urbanization could lead to a sudden spurt in GHG emissions (above 6 tonnes per capita). It is hence recommended that better results for a low-carbon society/economy could be achieved through sustainable urbanization, in the range of 34–67%, with less than 6 tonnes per capita of average GHG emissions.

Chapter 3, Role of cities in contributing to national urban GHGs, is an exhaustive review of GHG protocols, inventories, tools and peer-reviewed methodologies at the national, regional and local scale. It discusses the inconsistencies and inappropriateness of these in evaluating the overall urban carbon footprint of a country for its policy application. The author addresses this problem by emphasizing the need to adopt spatial disaggregation of national GHG emissions, based on 'location of origin' of these gases, technically known as the 'production perspective'. This is substantiated by quantitatively disaggregating of sectoral contributions of GHGs for urban areas in India. Against the conventional view that India is largely a rural society, where urban areas house marginalized citizens, mostly living in slums unable to meet their energy needs, hardly contributing to GHG emissions, this chapter brings forth that, in fact, Indian cities drastically contribute to global climate change, to an extent that while urban India is home to about one-third of the country's population, it contributes to at least two-thirds of national GHG emissions.

Chapter 4 investigates the spatial causations and drivers of GHGs in cities, studying parameters that normatively and empirically correlate with urban GHGs, major ones being climate type, city size, regional linkages, urban density, spatial structure and predominant landuse. This draws heavily from theory and evidence published in the literature to formulate indicators and metric for modelling. A correlation analysis is conducted in chapter 5, to test this model on selected Indian cities in different climatic and geographical regions. Based on favourable results, the test is expanded to a sample of 41 cities using Ordinary Least Squares (OLS) regression model. While highlighting critical parameters, the results are also presented in matrix that present thresholds for low impacts, medium impacts and high impacts of urbanization. The study also recommends how individual cities could mitigate climate change by modulating their spatial parameters while planning and managing their jurisdictional areas.

The study is exceptional in multiple ways. There are limited studies across the globe that have tried to theoretically and empirically discern carbon throughputs on the urban–rural continuum, from the perspective of a physical or spatial planner. While normatively, there used to be a pre-occupancy of attributing GHGs of countries and cities to their economic activity with 'income level' or GDP as the key indicator, which merely represents one of the development indices and rather fuels debates on North–South inequity. This research made an attempt to utilize spatial perspective to study patterns of carbon emissions emanating at different scales – thus obliterating the conventional North–South duality. The book underscores, with greater and more robust evidence that it is in fact these urban centres, irrespective of their national circumstances (developed or developing) that contribute to the most of the global GHGs. The national- and local-level findings are equally astounding, insightful and practically useful. They reason normative understanding with new and strong empirical evidence to inspire fresh ideas about urbanization and instruments that promote a low-carbon society and urban planning. This study attempts to answer, among others, the following key questions: What is the most favourable rate of a country's urbanization? What should be the appropriate economies of scale for cities? What should be the most suitable spatial pattern for a city? What are appropriate regulatory, economic or governance mechanisms to achieve a low-carbon city?

The research contributes to the prevailing academic discourse and multidisciplinary theories – urban metabolism, energy/ecological modelling, GHG accounting, spatial disaggregation, etc. At the same time, it feeds into practice with new methods/tools to energy and climate experts, urban economists, planners and geographers to rationally and equitably account for carbon throughputs of individual cities or cumulative urban areas within a country/region based on their spatial parameters. The book culminates with a series of suggestions that can facilitate economic policies, environmental strategies, spatial planning and an urban governance framework inclusive of green/low-carbon agenda.

The book is useful for both thinkers and doers, those who prefer looking at the larger picture, value new knowledge for practical applications but have a fetish for details. The narrative is systematically structured such that each chapter (2–6) after the introduction responds to a definite research objective. All references are meticulously documented and provided consistently at the end of each chapter so that the reader does not have to struggle with an exhaustive bibliography at the end of the book. In addition, there are suggested readings for those who want to delve deeper into the subject. The book tests a reader's learning after each chapter by asking basic and advanced sets of questions. This could prove helpful to graduate and postgraduate students preparing for examinations in this area. The most interesting and useful component is the *do it yourself exercises* designed at the end of almost every chapter. These should motivate readers to practice and master meticulous calculations in the simplest manner. While the book responds to several burning questions of the day, one hopes it raises the spirit of scientific interrogation and wonder among readers.

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