TOWARDS RESILIENT AND LOW-CARBON CITIES

Anthony Gad Bigio

Adjunct Professor of Sustainable Urban Planning
George Washington University
IPCC Lead Author, 5th Assessment Report

agbigio@gwu.edu

UMD Climate Action Forum, May 4, 2016

Recent supporting publications

Urban Climate 14 (2015) 116–137

Contents lists available at ScienceDirect

Urban Climate

journal homepage: www.elsevier.com/locate/uclim

A conceptual framework for an urban areas typology to integrate climate change mitigation and adaptation ☆

William Solecki [a,*], Karen C. Seto [i], Deborah Balk [a], Anthony Bigio [b], Christopher G. Boone [c], Felix Creutzig [d], Michail Fragkias [e], Shuaib Lwasa [g], Peter Marcotullio [h], Patricia Romero-Lankao [f], Timm Zwickel [k]

[a] City University of New York, Baruch College, School of Public Affairs, One Bernard Baruch Way, Box D-0901, New York, NY 10010, USA
[b] Sustainable Urban Planning, The George Washington University, USA
[c] School of Sustainability, Arizona State University, PO Box 875502, Tempe, AZ 85287-5502, USA
[d] Mercator Research Institute on Global Commons and Climate Change, Torgauer Str. 12-15, 10829 Berlin, Germany
[e] Boise State University, Micron Business and Economics Building Room 3246, 1910 University Drive, Boise, ID 83725, USA
[f] Urban Futures (RAL-ISP), National Center for Atmospheric Research, PO Box 3000, Boulder, CO 80307, USA
[g] Makerere University, Department of Geography, P.O. Box 7062, Kampala, Uganda
[h] City University of New York, Hunter College, Department of Geography, 695 Park Ave, 1003E North Building, New York, NY 10065, USA
[i] Yale University, School of Forestry & Environmental Studies, 380 Edwards Street, Room 102, New Haven, CT 06511, USA
[j] City University of New York, Hunter College, Department of Geography, 695 Park Avenue, 1215E, New York, NY 10065, USA
[k] Potsdam Institute for Climate Impact Research (PIK), PO Box 60 12 03, 14412 Potsdam, Germany

ARTICLE INFO

Article history:
Received 24 December 2014
Revised 12 July 2015
Accepted 14 July 2015

Keywords:
Urbanization
Typology
Climate change
GHG emissions
Vulnerability

ABSTRACT

Urban areas are key sources of greenhouse gas (GHG) emissions and also are vulnerable to climate change. The recent IPCC Fifth Assessment Report illustrates a clear need for more research on urban strategies for climate change adaptation and mitigation. However, missing from the current literature on climate change and urban areas is a conceptual framework that integrates mitigation and adaptation perspectives and strategies. Because cities vary with respect to development histories, economic structure, urban form, institutional and financial capacities among other factors, it is critical to develop a framework that permits cross-city comparisons beyond simple single measures like population size.

The primary purpose of this paper is to propose a conceptual framework for a multi-dimensional urbanization climate change typology that considers the underlying and proximate causes of GHG emissions and climate change vulnerabilities. The paper reviews some of the basic steps required to build such a typology and associated challenges that must be overcome via a demonstration of a pilot typology with nine case study cities. The paper shows how the proposed framework can be used to evaluate and compare the conditions of GHG emissions and climate change vulnerability across cities at different phases in the urbanization process.

☆ All authors were equally responsible for the development of the paper. The paper emerged as a result of group workshop discussion. Karen Seto and William Solecki took the leadership role of developing the paper in its final form.

* Corresponding author.
E-mail addresses: wsolecki@hunter.cuny.edu (W. Solecki), karen.seto@yale.edu (K.C. Seto), Deborah.Balk@baruch.cuny.edu (D. Balk), agbigio@email.gwu.edu (A. Bigio), Christopher.G.Boone@asu.edu (C.G. Boone), creutzig@mcc-berlin.net (F. Creutzig), michailfragkias@boisestate.edu (M. Fragkias), lwasa_s@arts.mak.ac.ug (S. Lwasa), Peter.Marcotullio@hunter.cuny.edu (P. Marcotullio), prlankao@ucar.edu (P. Romero-Lankao), timm.zwickel@pik-potsdam.de (T. Zwickel).

http://dx.doi.org/10.1016/j.uclim.2015.07.001
2212-0955/

Towards Resilient and Low-Carbon Cities: New Challenges and Opportunities

Anthony G. Bigio

THE GROWTH DIALOGUE

Key presentation messages

- Urban climate action should generally include both adaptation and mitigation in the same programs
- A number of obstacles make this integration difficult
- Climate action in OECD cities revisits and redefines EXISTING urban systems, infrastructure, built environment, services, management arrangements
- Climate action in developing and emerging cities should be part of building up the INSUFFICIENT infrastructure, built environment, services, institutions

Examples of integrated climate action

- Green buildings or retrofitted buildings provides thermal comfort (adaptation) in warming climates while reducing energy consumption (mitigation)
- Green infrastructure to manage excessive runoff and flooding (adaptation) will generate cooling and absorb carbon emissions (mitigation)
- Effective waste management and recycling protect waterways from clogging (adaptation) but allow for methane sequestration (mitigation)

Obstacles to A and M integration

- Separate scientific expertise and literature: see IPCC WG II (adaptation) and WG III (mitigation), (but two inter-related urban chapters in 5th AR)
- Separate on-the-ground implementation agencies:
  - Adaptation: public works, roads and bridges, FEEMA …
  - Mitigation: energy, pollution management, DOE …
- Lack of integrative models:
  - How to determine if a city needs more A or more M ?
  - How to compare the adaptation needs or mitigation opportunities of different cities with each other ?

An integrated urban climate typology

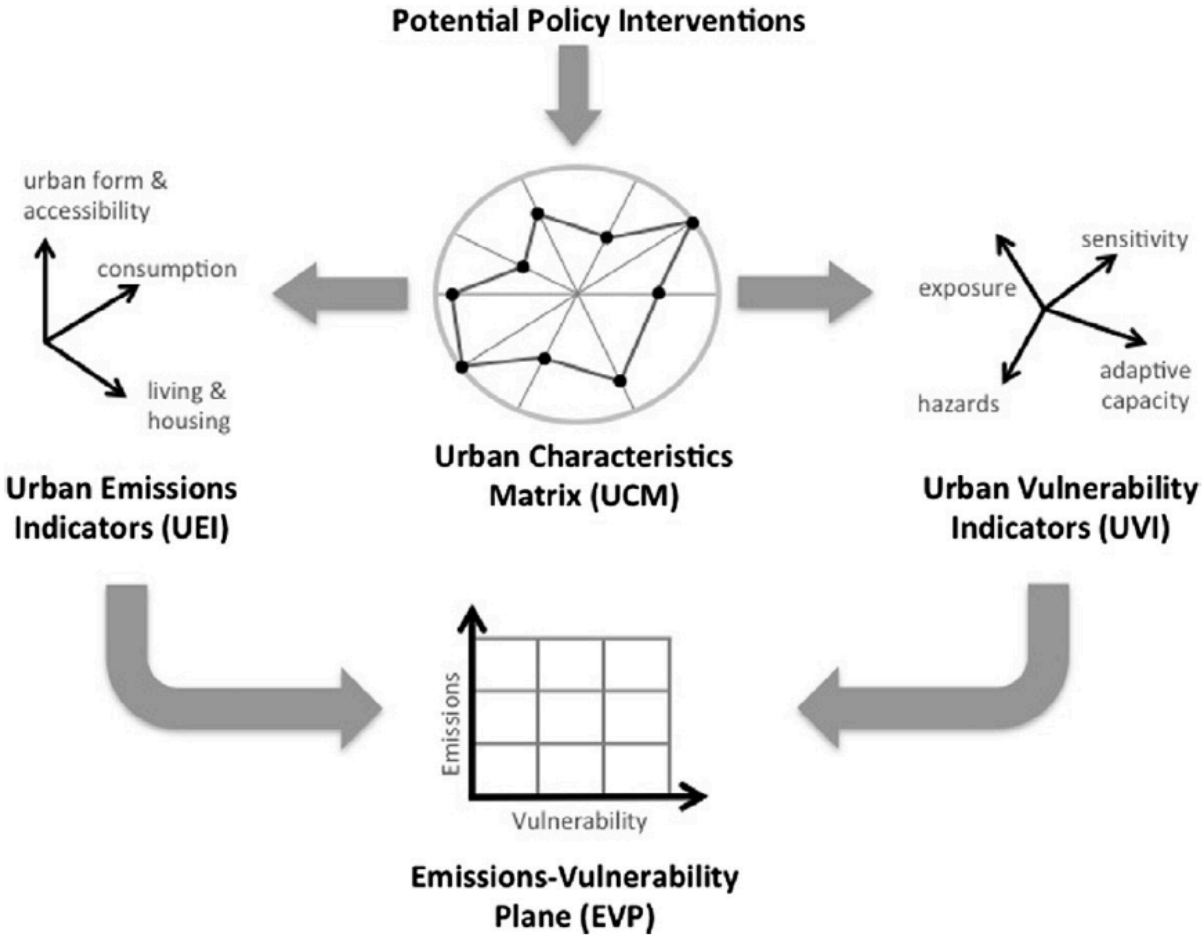
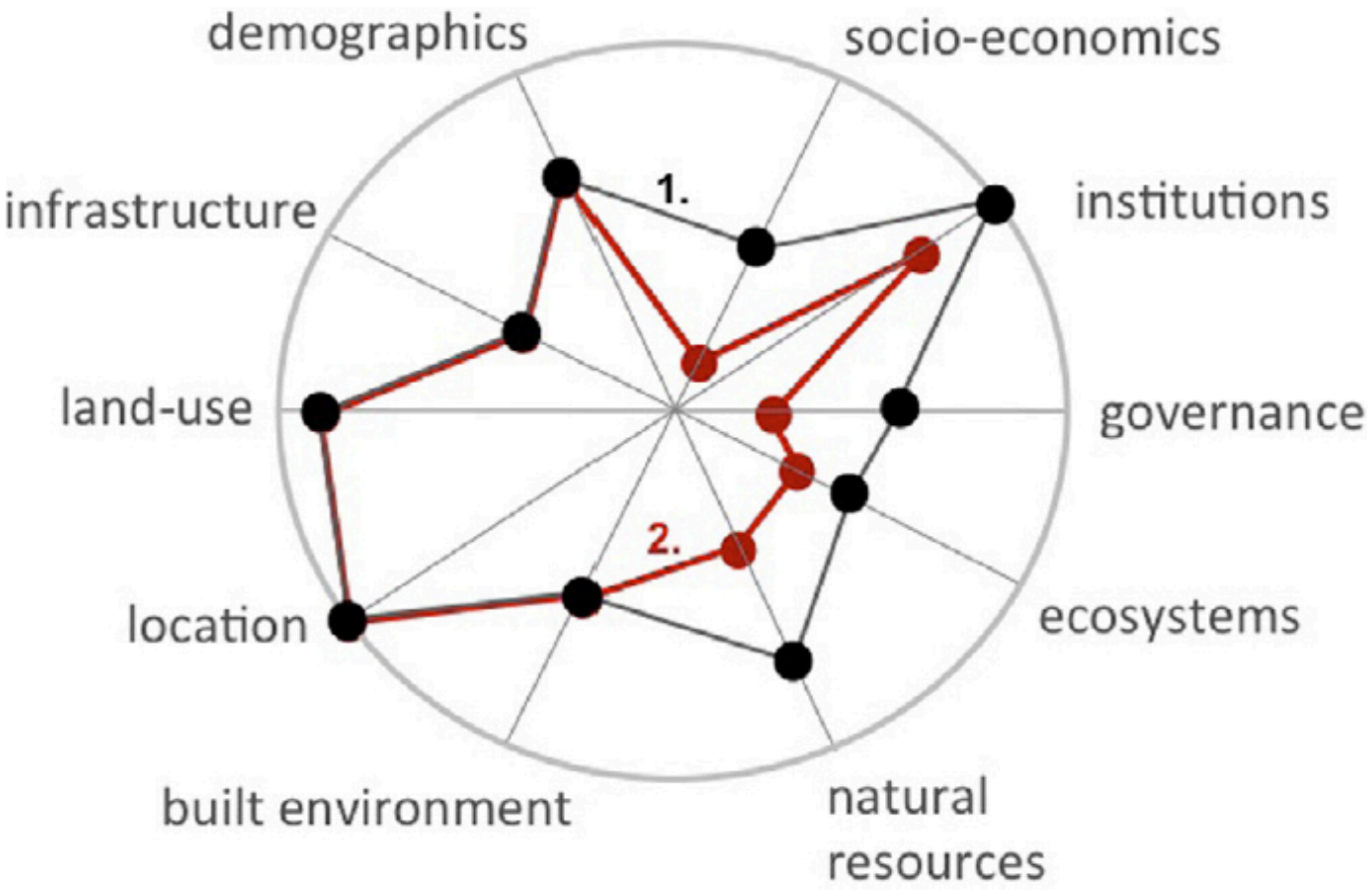
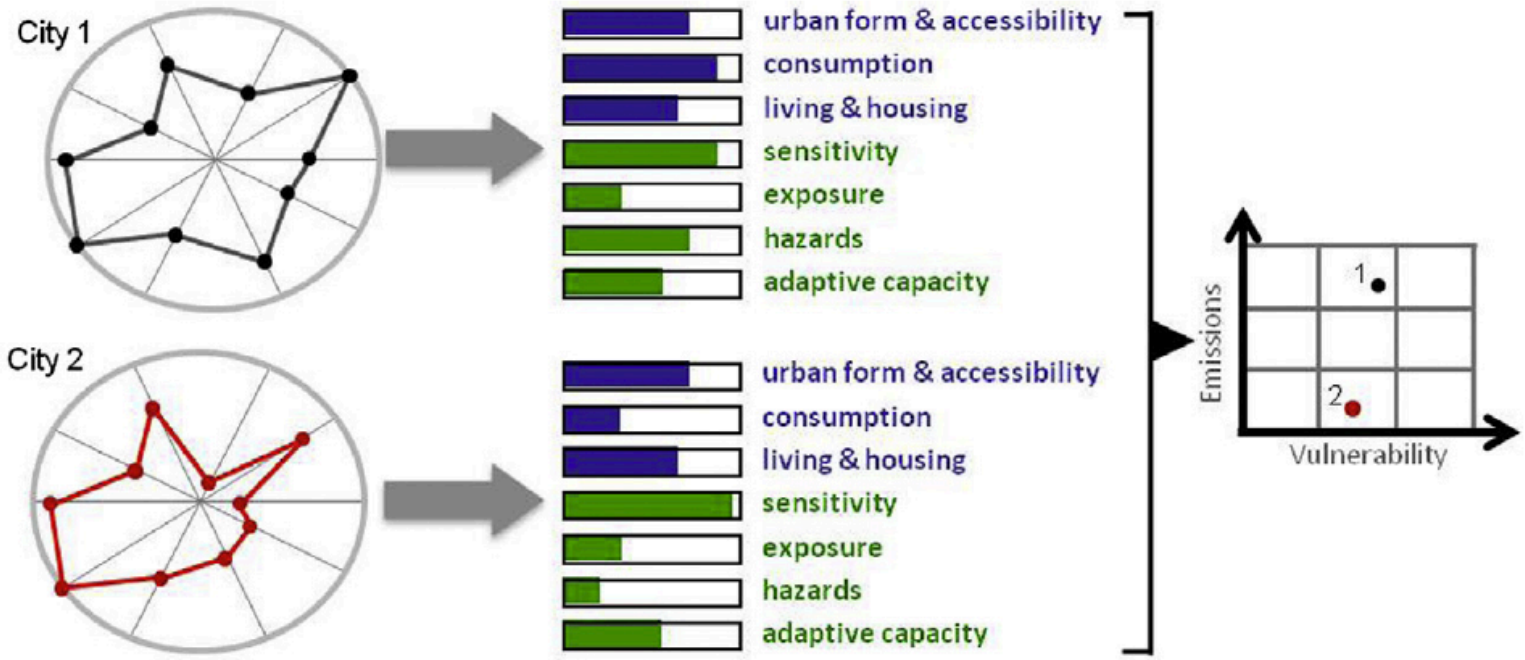


Fig. 1. Schematic of the Urbanization-Climate Change Typology Framework (UTF).

Key general urban characteristics



Emissions and vulnerability indicators



(a) *Individual City Spider Graphs with Composite Dimension Spokes*

(b) *Emissions (Blue) and Vulnerability (Green) Indicators Derived from Values of Dimension Spokes*

(c) *Emission and Vulnerability (X, Y) Located on the Emissions-Vulnerability Plane*

Urban areas typology for A and M

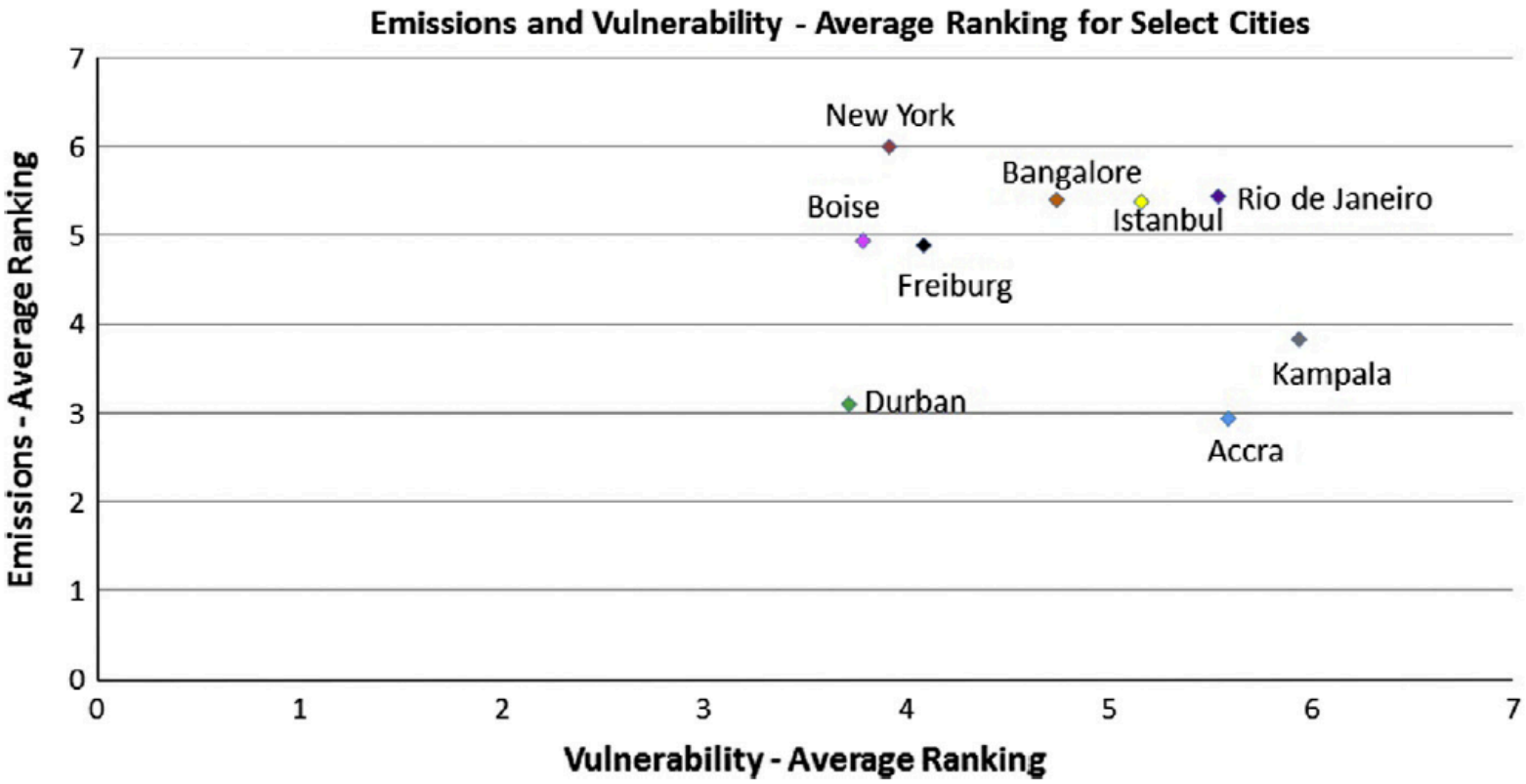
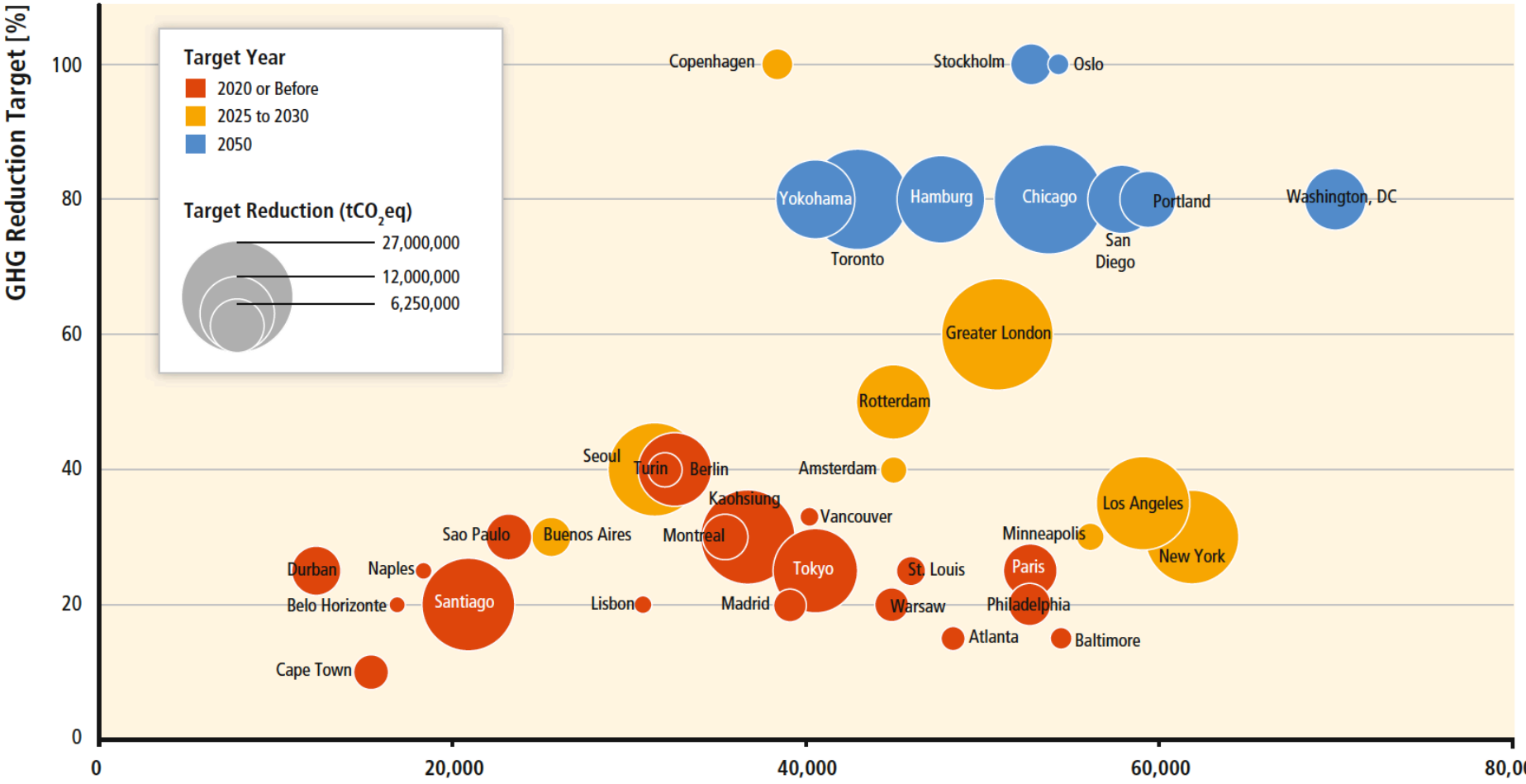


Fig. 4. Emissions and vulnerability average ranking for nine select cities.

Climate action prevalent in OECD cities



Source: IPCC 5AR, WGII, Ch.12, Fig. 12.12

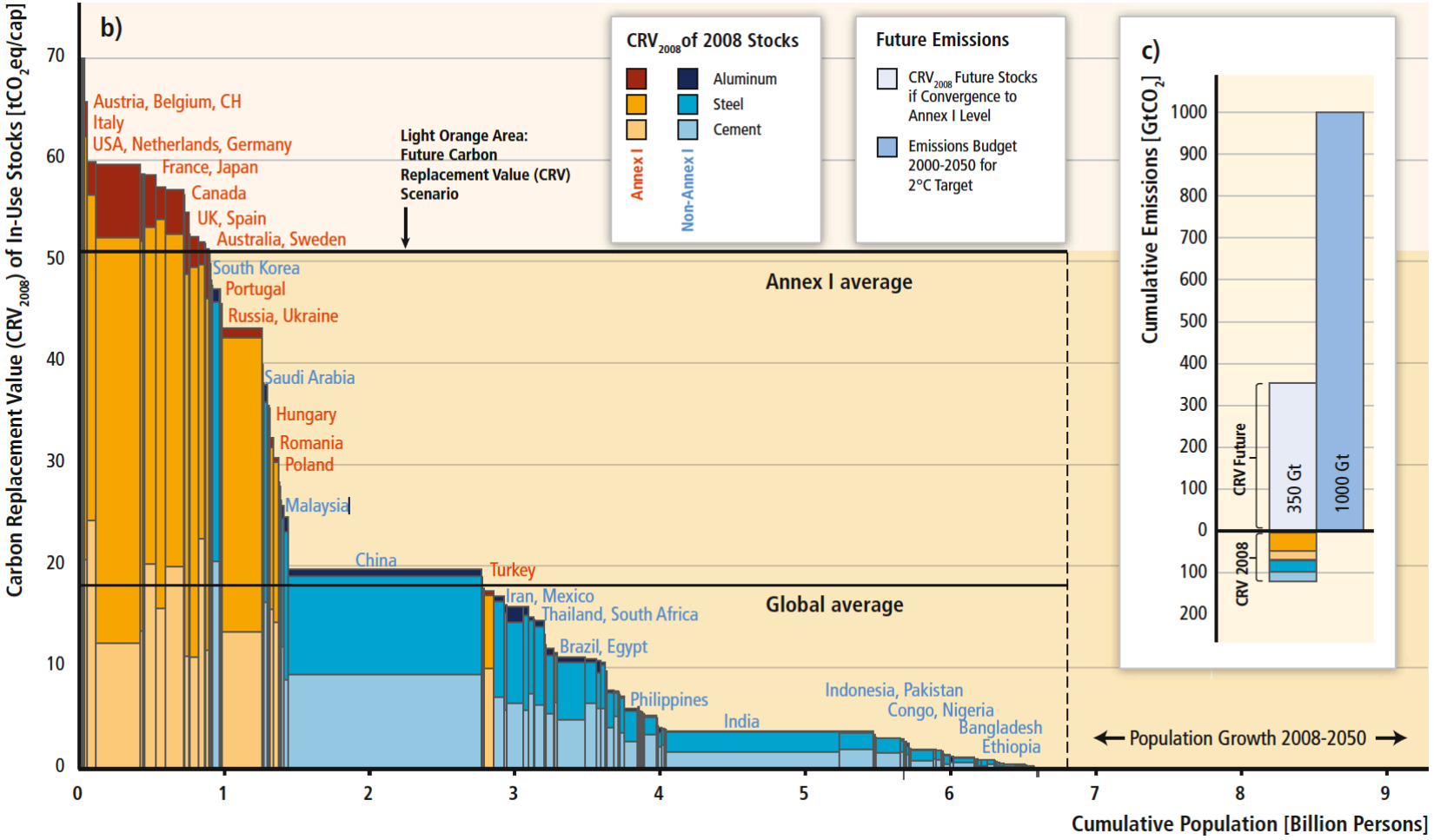
But non-OECD cities growing more !

URBAN GROUP	PROJECTED BASE GDP GROWTH FROM 2012-2030, USD TRILLIONS	PROJECTED BASE CASE EMISSIONS GROWTH[1] FROM 2012-2030, MEGATONNES OF CO_2	PROJECTED POPULATION IN 2030, BNS	PER CAPITA IN 2030, TONNES OF CO_2 PER PERSON
Emerging Cities e.g. Bangalore, Kunming, Pune, Puebla	16	3230	~1.3	~7
Small Urban Areas Inc. villages, small towns, peripheral industrial areas pop. < 0.5 million	16	1220	~2.2	~4.6
Established Cities e.g. Stuttgart, Minneapolis, Stockholm, Hiroshima	11	390	~0.4	~12.1
Global Megacities e.g. Beijing, New York, London, Rio de Janeiro	10	1050	~0.6	~7.1
Total growth	~ 52	~ 5,890	**Total population in 2030** ~ 4.5	
Share of world growth	~ 87%	~ 65%	**Share of world pop. in 2030** ~ 55%	

Source: Global Commission on Economy and Climate 2014

2.3b more urban residents in developing and emerging countries against 0.2b in OECD countries btw 2010 and 2050 (UNDESA)

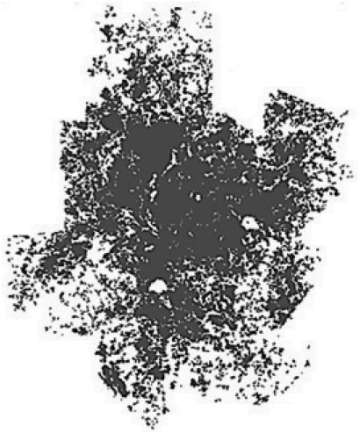
Likely emissions from urban build-up



Source: IPCC 5AR, WGII, Ch.12, Fig.12.21

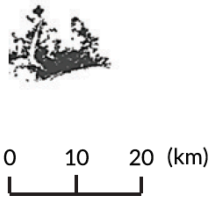
Mitigation, green growth, welfare

ATLANTA'S BUILT-UP AREA



POPULATION:	5.25 MILLION
URBAN AREA: TRANSPORT	4,280 KM²
CARBON EMISSIONS:	7.5

BARCELONA'S BUILT-UP AREA



POPULATION:	5.33 MILLION
URBAN AREA: TRANSPORT	162 KM²
CARBON EMISSIONS:	0.7

Source: Bertaud and Richardson, 2004

Adaptation, development, resilience

Source: “Rebuild by design” post-Sandy program: Coney Island, New York