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MEGACITIES AND THE COAST

Risk, Resilience and Transformation

Edited by MARK PELLING and SOPHIE BLACKBURN

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Mark Pelling and
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Megacities and the Coast

Based on a major international study, this volume provides a synthesis of scientific knowledge on the urbanisation processes, environmental impacts, and policy response options, and disaster risk management challenges that are associated with coastal megacity development. It is the primary output of a major international scientific project sponsored by the International Geosphere Biosphere Programme, the Land-Ocean Interactions at the Coastal Zone programme of IHDP/IGBP and others. It brings together the work of over 60 contributing authors and an international review board.

This volume presents the international policy and academic community with an unbiased and high-quality assessment of social–ecological systems interaction in coastal megacities. One of its main messages is that while we know a great deal about megacities of more than ten million people and about urban processes, and about coasts and their physical and ecological processes (aquatic, physical and atmospheric), there is relatively little work that focuses primarily at points of intersection between these. The book responds to this gap by providing the first global synthesis of megacity and large urban region urbanisation on the coast. Its focus is on environmental and development challenges, climate change and disaster. It is interdisciplinary and brings together world-recognised scientists (including many IPCC lead authors) on urban climate and atmosphere, disaster risk management, demography and coastal environments.

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Source: UN-HABITAT Global Urban Observatory (UN-HABITAT 2008, pp.11)

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Source: City population data sourced from UN-DESA (2012b) World Urbanisation Prospects 2011 table on the thirty largest urban agglomerations. Hazard data sourced from Klein *et al.* (in Kreimer *et al.*, World Bank, 2003, pp.104), Caljouw *et al.* (2005), Li (2003), Nur *et al.* (2001), Ward *et al.* (2011) and expert judgement. World map provided by Natural Earth (available from www.naturalearthdata.com).

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Acronyms

ADB	Asian Development Bank
CBDP	community-based disaster preparedness
CCA	climate change adaptation
CCM	climate change mitigation
CCN	concentration of condensation nuclei
CCSM	Community Climate System Model
COAMPS	Coupled Ocean-Atmosphere Mesoscale Prediction System
DKI	Special Capital Territory of Jakarta
DRM	disaster risk management
DRR	disaster risk reduction
DTR	diurnal temperature range
EAC	Eko Atlantic City
ENSO	El Nino Southern Oscillation
ESS	ecosystem services
FAO	Food and Agriculture Organisation
GCM	global climate model
GDP	gross domestic product
GHG	greenhouse gas
GEC	global environmental change
GECAFS	Global Environmental Change and Food Systems
ICZM	integrated coastal zone management
IPC	integrated food security phase classification
IPCC	Intergovernmental Panel on Climate Change
LASG	Lagos State Government
LECZ	low elevation coastal zone
LLGHG	long-lived greenhouse gases
LOICZ	Land-Ocean Interactions on the Coastal Zone
MCGM	Municipal Corporation of Greater Mumbai
MM	Metro Manila
MSP	maritime spatial planning
MEA	Millennium Ecosystem Assessment
MENA	Middle East and North Africa
NCAR	National Center for Atmospheric Research
NPCC	New York City Panel on Climate Change
NYC	New York City

PM	particulate matter
RCP	representative concentration pathways
SLR	sea-level rise
SREX	IPCC Special Report for Managing the Risks of Events and Disasters to Advance Climate Change Adaptation
TOA	top of the atmosphere
UBL	urban boundary layer
UET	urban environmental transition
UHI	urban heat island
UN-DESA	United Nations Department for Economic and Social Affairs
UNCLOS	United Nations Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFPA	United Nations Population Fund
UN-HABITAT	United Nations Human Settlements Programme
UNISDR	International Secretariat for Disaster Reduction
WHO	World Health Organisation

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Executive summary

Mark Pelling and Sophie Blackburn

The coast represents a highly dynamic interface between land, sea and atmosphere, subjecting urban development in this zone to a unique set of pressures and opportunities. However, whilst offering many benefits, a coastal location is also exposed to varied sources of risk – many of which are being exacerbated in the context of the new and uncertain pressures associated with global environmental change. Such concerns are most salient in megacities – defined as having a population exceeding 10 million – where the concentration of human life and assets is greatest, and where consequences for failure as well as opportunities for innovative solutions remain high. Global trends in urban geography have acquired heightened significance as the majority of the world's population is now recognised as urban-dwelling. Simultaneously, megacity development itself exerts pressures on coastal ecosystems and geomorphology, with both short and long-term implications for ecological and human wellbeing and sustainability. The degree to which megacity residents, property and ecologies are exposed and vulnerable to environmental hazards is an outcome not only of technological and economic capacity, but – more importantly – of governance systems, dominant development priorities and values. How far current trajectories for environmental and social change are shifting the balance between opportunity and risk, and for whom, are thus important questions of our time.

Responding to this globally strategic concern and opportunity for sustainable development, this volume is the principle outcome of an international, interdisciplinary assessment of global scientific knowledge on the interaction of megacities and the coastal environment. It is the product of collaboration between the Land-Sea Interactions at the Coastal Zone (LOICZ) hotspot theme on Urbanization in Coastal Zones, and the International Geosphere Biosphere Programme (IGBP). It aims to begin the process of building an international community of researchers that can lead transdisciplinary expertise, and frame future research on megacities and urban regions on the coast. The completion of this volume in itself has brought together an international group of more than 60 scientists from a multitude of subject specialisms, from across North and South America, Asia, Africa, Europe and Australasia. Lead authors and a number of contributing authors were selected via the LOICZ Open Science Congress, Yantai, China, 2011, with additional opportunities for inputs from the international scientific community encouraged through sessions at the IHDP Open Science Meeting, London, 2012, and the 2nd US Coastal City Summit, St Petersburg, Florida, 2012. The review process has been coordinated with advice from a senior steering and review committee including members of LOICZ and IGBP.

Context

Megacities are large and highly dynamic systems, and represent concentrated sites of human life and assets as well as of pollution and ecological stress. Due to this combination, as neighbourhoods and cities grow in size and resource capacity, transformations in social-environmental relations are also observed. Over time, local environmental hazards associated with inadequate sanitation and services tend to be replaced by risks that accrue at the city scale and globally, as cities progress through industrial and post-industrial stages. Furthermore the increasingly interconnected nature of urban places at a global scale alters the nature and rate of urban change. Accountability for this can be difficult to trace, since the sites of risk production and impact are often far removed. For example, there are clear justice consequences for globalised megacities that are important nodes in the production of pollution and greenhouse emissions which have negative impacts on distant ecologies and populations at regional and global scales. Historically, coastal megacities have recorded some of the highest human and economic losses to disaster events, however this is not a trend which need necessarily continue into the future: simultaneous with being sites of extreme risk, megacities are also centres of capacity, ingenuity and resource.

The complexity and reach of urbanisation processes is matched by those of coastal environmental systems, which are amongst the most diverse ecological systems worldwide. Beyond their intrinsic value, these are systems that offer significant ecosystem services ranging widely from coastal protection to fisheries and recreation. Management of hazards, vulnerability and environmental management in megacities is inherently complex, and governance responses require attention to multiple scales of impact, and negotiation between many competing interests.

The Aim: an integrated agenda for research and policy on large coastal, urban systems

The scientific community understands a good deal of the drivers and constraints acting in megacity systems and coastal systems, and work from social and natural sciences and integrated and trans-disciplinary programmes of research have made substantial recent advances. However, there is one over-riding and critical gap: the lack of integration between urban and coastal research. As yet, we know much less about the interaction of coastal and large urban systems than we do of the constituent parts. Knowledge of the dynamic two-way interactions between megacities and the coast is, we argue, a large and dangerous gap in our collective knowledge.

This global review seeks to address this gap, adopting an interdisciplinary approach that is unique in drawing on both the physical and social sciences to explore the causes, impacts and management of environmental degradation, human vulnerability, and feedbacks between the two. In an attempt to delineate the contours of the relationship between mega-urbanisation and coasts that is explored in detail in the rest of the volume, this Executive Summary highlights seven key messages arising from this synthesis review project.

Key Message 1

Fragmentation, agglomeration and disproportionately rapid expansion in less wealthy countries are major global trends in coastal megacity development

Megacities present important lessons on planning and risk management at scale. There are currently 23 worldwide, 16 of which are in the coastal zone – defined here as the area within 100km and 50m elevation from the coast. Of these, ten are in Asia (Tokyo, Mumbai, Shanghai, Guangzhou, Shenzhen, Kolkata, Karachi, Manila, Osaka-Kobe, Jakarta), two each in Latin America (Buenos Aires, Rio de Janeiro) and North America (New York City, Los Angeles), and one each in Africa (Lagos) and Europe (Istanbul). However there are many problems inherent in defining the above list. Most significant among these are: 1) the use of multiple conflicting parameters in defining the boundary between 'urban' and 'rural', a dichotomy which is increasingly rejected in favour of a 'continuum' concept; 2) ambiguity over uses of the term 'urbanisation', which range from demographic to structural interpretations; and 3) the intuitive difficulty of excluding rapidly growing cities lying below the 10 million threshold, and those lying slightly outside the 'coastal' limits but whose growth nonetheless has relied heavily on the features of a coastal or estuarine location (for example Cairo, London and Sao Paulo).

Further complicating megacity identification are global trends of urban sprawl, fragmentation, and agglomeration, which serve to blur city boundaries. Recent reports highlight the growing importance of peri-urban areas in regional economies, which are expanding largely as a result of urban sprawl. In order to incorporate such 'grey areas' – which nonetheless are a key feature of contemporary megacities – a joint focus on megacities and 'urban regions' is preferred in this volume. This also seeks to take account of 'mega-regions', where several megacities have agglomerated through urban expansion, or where large urban areas have developed with multiple foci rather than a single epicentre. Currently the largest of such agglomerations is the Hong Kong-Shenhzen-Guangzhou region in China, which has a total population of approximately 120 million.

Set against these trends is the relatively static growth of megacities in Europe, the Americas and East Asia, relative to the very rapid urban growth observed in Central Asia and Africa. Rapid urbanisation is especially consequential in Africa where demography, economies and environments are set to be transformed in the next decade. The implications for international trade networks and distributions of global capital is still a young field, and is an important area for future inquiry that should focus on the politics of internal trade-offs between economic development, human well-being and environmental sustainability. The importance of this research agenda is magnified by the risks to trade associated with a coastal location and additional pressures from global environmental change anticipated to have a disproportionately significant impact on low- and middle-income countries.