Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems

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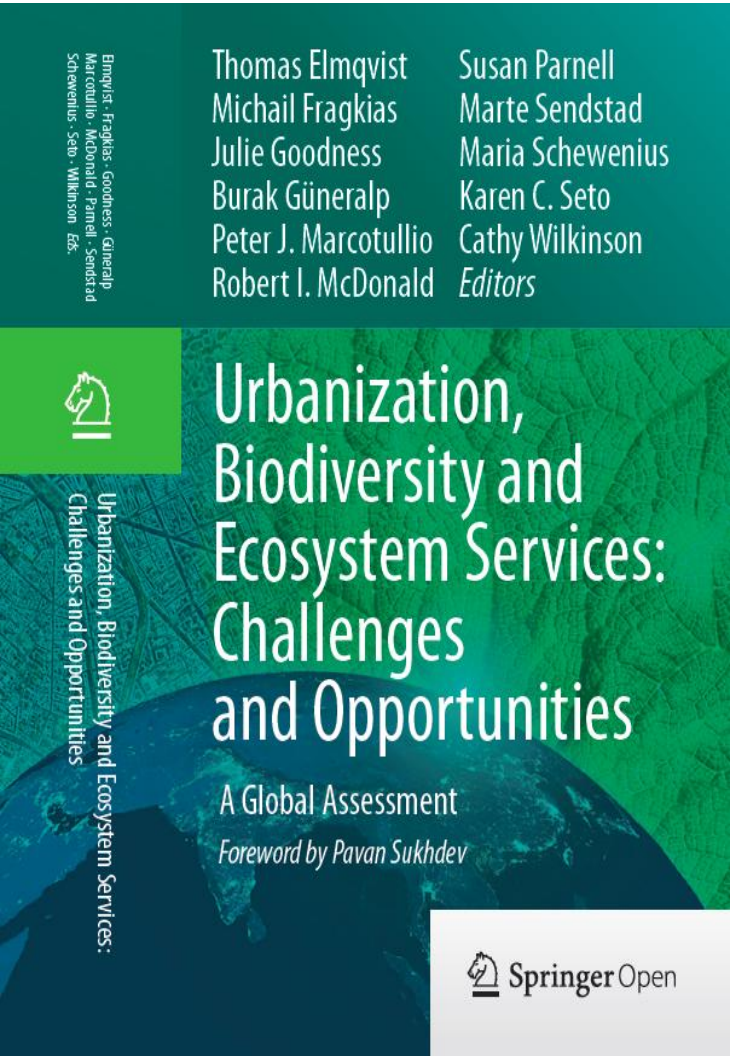
IUCN



Book launch of the Cities and Biodiversity Outlook
Scientific Analysis and Assessment

URBANIZATION, BIODIVERSITY AND ECOSYSTEM SERVICES: CHALLENGES AND OPPORTUNITIES

Thursday 10 October 2013

12:30 – 16:00 (with lunch)

Royal Belgian Institute of Natural Sciences,
Rue Vautier 29 - 1000 Brussels

"…to prepare an assessment of the links and opportunities between urbanization and biodiversity..."

Decision X/22, Conference of the Parties, 10th meeting
Nagoya, Japan, October 2010

Convention on Biological Diversity

Stockholm Resilience Centre
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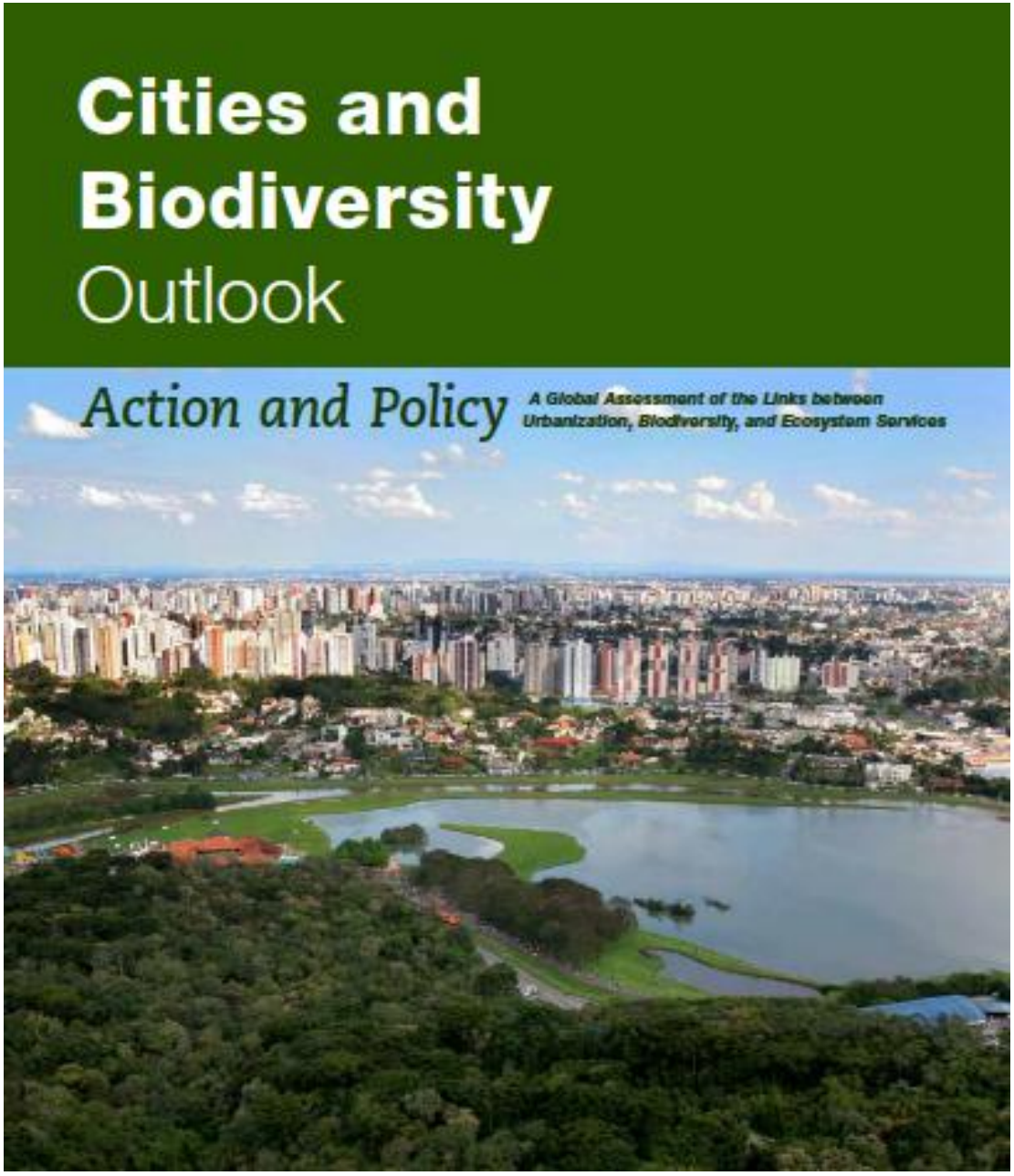
ICLEI Local Governments for Sustainability



Ban Ki Moon:
"The principal message is that urban areas must offer better stewardship of the ecosystems on which they rely"

The increasing number and diversity of urban policies and programs on human health and biodiversity interlinkages are providing a rich source of knowledge for cities to use and build on (see Figure 4.3). Given the unique position of cities at the implementation interface between people and biodiversity, we must widely share our understanding, predictions, and lessons learned through local, regional, and global collaboration networks. By looking at biodiversity through the lens of health and also looking at health with an eye for biodiversity, we can achieve mutual health benefits for cities and biodiversity.

Select References

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Figure 2.1. Photo of the Mexican jaguar (*Panthera onca hernandesii*). One of the world's largest cities, Mexico City has 8.8 million inhabitants in the city proper and about 22 million in the metropolitan area. The city supports about 2 percent of all the known species in the world, including 3,000 species of plants, 350 species of mammals, 316 species of birds, and many species of aquatic plants and animals.

URBAN NATURE FACTS

- Even backyard gardens can harbor significant biodiversity: a study of 61 gardens in the city of Sheffield, UK, found 4,000 species of invertebrates, 80 species of lichen, and more than 1,000 species of plants.
- Cities can be important habitats for a diverse bee fauna. Bees in urban and suburban settings have a richer, healthier diet than bees in modern intensive farmland settings.
- Medium-sized carnivores such as the red fox, coyote, Eurasian badger, and raccoon living in or around urban areas may achieve higher population densities than they do under natural conditions.

rarer species. Furthermore, ecosystem services may be delivered even by ecosystems that are degraded or that contain low biodiversity. While pristine ecosystems typically provide a greater number of ecosystem services than those that are degraded or altered, many ecosystems that are significantly altered from their natural state can still provide useful goods and services (e.g., rain storage, clean air and water).

[illegible] fragmented ecosystems is likely to increase ecological functionality as a whole and therefore to maximize the ecosystem services offered. There are diverse and innovative ways to connect natural ecosystems. Planting trees with overarching canopies can help small mammals, birds, and insects cross roads and highways (see Figure 2.3). Roadside planting that mimics the multilayering of forests—for example, a composite of tall trees, medium-sized trees, shrubs, and understory vegetation—can cater to a diversity of animal users. Ecolinks such as underground tunnels and vegetated overhead bridges can help connect natural areas. All of these efforts can complement the important roles played by protected areas in cities. Of course,

Many cities contain protected areas within or [illegible] outside their borders that provide important [illegible] buttons to biodiversity. In Cape Town, [illegible] National Park, an iconic landmark [illegible] rich in endemic plants and animals, [illegible] founded by the municipality. In Mumbai, [illegible] National Park—known for its dense semi-evergreen forests, 280-plus species [illegible] species of butterflies, and 40 species of [illegible] including a small population of leopards—protects [illegible] 104 square kilometers entirely within [illegible] city. In Stockholm, the National Urban [illegible] contains [illegible] 00 hectares with high biodiversity, [illegible] city center. In Kenya, Nairobi National [illegible] (see Figure 2.2), just 7 kilometers from the center of Nairobi, is home to lions, giraffes, cheetah, rhinos, buffalo, and more than 400 species of birds. In the western USA, Saguaro National Park lies just outside the City of Tucson and protects about 40,000 hectares of the unique Sonoran Desert ecosystem.

These examples show that with proper planning and management, cities can retain substantial components of native biodiversity.

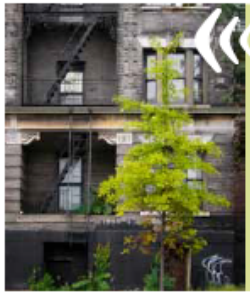
Biodiversity includes common species too

Biodiversity does not have to be rare to be valuable—it refers to common and widespread species too. Monitoring the status of common species is important because fluctuations in their populations can indicate environmental problems. A case in point is the quintessentially urban House Sparrow (*Passer domesticus*) whose populations have recently declined drastically in Eurasian cities throughout its native range, for reasons that are not yet entirely clear. Understanding the ecology of common species may help us improve habitats for them as well as for

AICHI TARGET 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Cities can help preserve forests and wetlands of critical biodiversity by ensuring the connectivity of existing and future protected areas. Managing footprints (best done at the provincial, state, or regional level) can also make a difference.

Figure 2.2. Nairobi National Park, 7 kilometers from the center of Nairobi, is renowned for its wildlife. More than 100 species of mammals and 400 species of birds occur in the park.



More Trees, Less Childhood Asthma: New York City

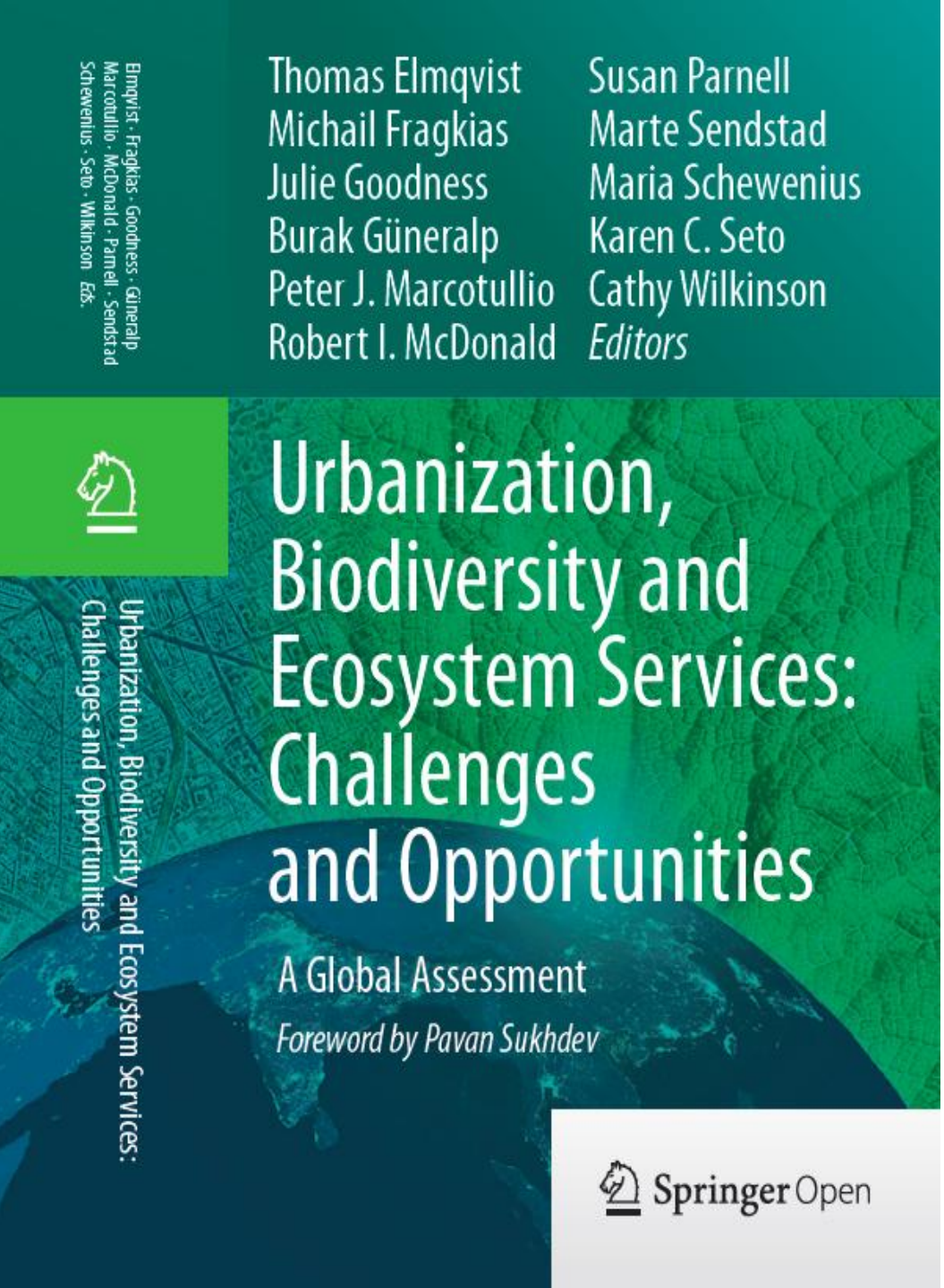
Rates of childhood asthma in the USA increased by 50 percent between 1980 and 2000, with the highest rates reported in poor urban communities. In New York City, where asthma is the leading cause of hospitalization among children under age 15, researchers at Columbia University studied the correlation between numbers of trees on residential streets and incidences of childhood asthma. They found that as the number of trees rose, the prevalence of childhood asthma tended to fall, even after data were adjusted for sociodemographics, population density, and proximity to pollution sources. How might trees reduce the risk for asthma? One explanation is that they help remove pollutants from the air. Another is that trees may be more abundant in neighborhoods that are well maintained in other ways, leading to lower exposure to allergens that trigger asthma. Yet another is that leafy neighborhoods encourage children to play outdoors, where they are exposed to microorganisms that help their immune systems develop properly. Further studies will provide a clearer picture of whether street trees really do make for healthier children: New York City is currently in the midst of planting a million new trees by 2017.

The Many Benefits of Urban and Peri-Urban Agriculture

Raising local crops and livestock can increase knowledge of and interest in the biophysical and food-growing processes, empower citizens to influence sources of food production, strengthen links to local food systems, and encourage healthier lifestyle choices. Greater food self-reliance, cheaper food prices, greater accessibility to fresh and nutritious products, and poverty alleviation are all key benefits that can arise from urban agriculture with sound decision-making and planning of the cities' ecosystems. The advantages of urban and peri-urban agriculture have been noted by the UN Food and Agriculture Organization (FAO) and by the World Health Organization's Healthy Cities Programme, which appeals to local governments around the world to include urban and peri-urban agriculture in their urban plans.

From Open Dump to Greenery: Mumbai's Gorai Dump Closure Project

The city of Mumbai, India, generates about 6,500 tons per day of municipal solid waste and about 2,400 tons per day of construction waste. For almost [illegible] years, that waste went to Goral Dump—a 20-hectare open site in Mumbai's western suburbs. Situated [illegible] creek and close to residential areas, the dump had caused significant environmental damage and [illegible] been known as one of the unhealthiest places in Mumbai. Closure of the site in 2009 involved [illegible] and reforming the heaps of garbage (their [illegible] height was 26 meters), covering them with impermeable [illegible], and converting them into a high-quality [illegible] area. The next step will be installing a power [illegible] that will run on methane gas from the decomposing garbage—thereby producing electricity as well as reducing greenhouse gas emissions. The project has already yielded many public-health and lifestyle benefits that have transformed the lives of local residents. They have a beautiful new green space to enjoy, air and water quality have improved, breeding flies and rodents have been eliminated, and property values in the area have increased fivefold.



- The world's first scientific assessment of how urbanization impacts biodiversity and ecosystem services
- Focuses on Challenges **and** Opportunities:
  - Human health
  - Food security
  - Water security
  - Climate change adaptation
- Analyses urbanization on global, regional as well as local scales

Open access

Cities and Biodiversity Outlook

Convention on Biological Diversity

ICLEI Local Governments for Sustainability

CBO Inter-Agency Task-Force

CBD	Braulio Ferreira de Souza Dias, Montreal, Canada; Executive Secretary
FAO	Julien Custot, Rome, Italy; Facilitator, Food for the Cities
ICLEI	Kobie Brand, Cape Town, South Africa; Global Coordinator for Biodiversity
IUCN	Hans Friederich, Gland, Switzerland; Regional Director for Europe
UN-DESA	Mohan Peck, New York, USA; Senior Sustainable Development Officer and Focal Point for Sustainable Cities Keneti Faulalo, New York, USA; Interregional Adviser on SIDS
UNEP –WCMC	Damon Stanwell-Smith, Cambridge, UK; Senior Programme Officer, Ecosystem Assessment Project Coordinator, Biodiversity Indicators Partnership
UNESCO	Gretchen Kalonji, Paris, France; Assistant Director-General for Natural Sciences Ana Persic, New York, USA; Science Specialist
UN-Habitat	Rafael Tuts, Nairobi, Kenya; Chief of the Urban Environment and Planning Branch
UNU-IAS	Anne McDonald, Kanazawa, Japan; Director of the Operating Unit Ishikawa Kanazawa
UNU-ISP	Srikantha Herath, Tokyo, Japan; Senior Academic Programme Officer

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Content (selected)

A Global Outlook on Urbanization
Karen C. Seto, Susan Parnell, and Thomas Elmqvist

History of Urbanization and the Missing Ecology
Thomas Elmqvist, Charles L. Redman, Stephan Barthel, and Robert Costanza

Urbanization and Global Trends in Biodiversity and Ecosystem Services
Robert I. McDonald, Peter J. Marcotullio, and Burak Güneralp

Urban Ecosystem Services
Erik Gómez-Baggethun, Åsa Gren, David N. Barton, Johannes Langemeyer, Timon McPhearson, Patrick O'Farrell, Erik Andersson, Zoé Hamstead, and Peleg Kremer

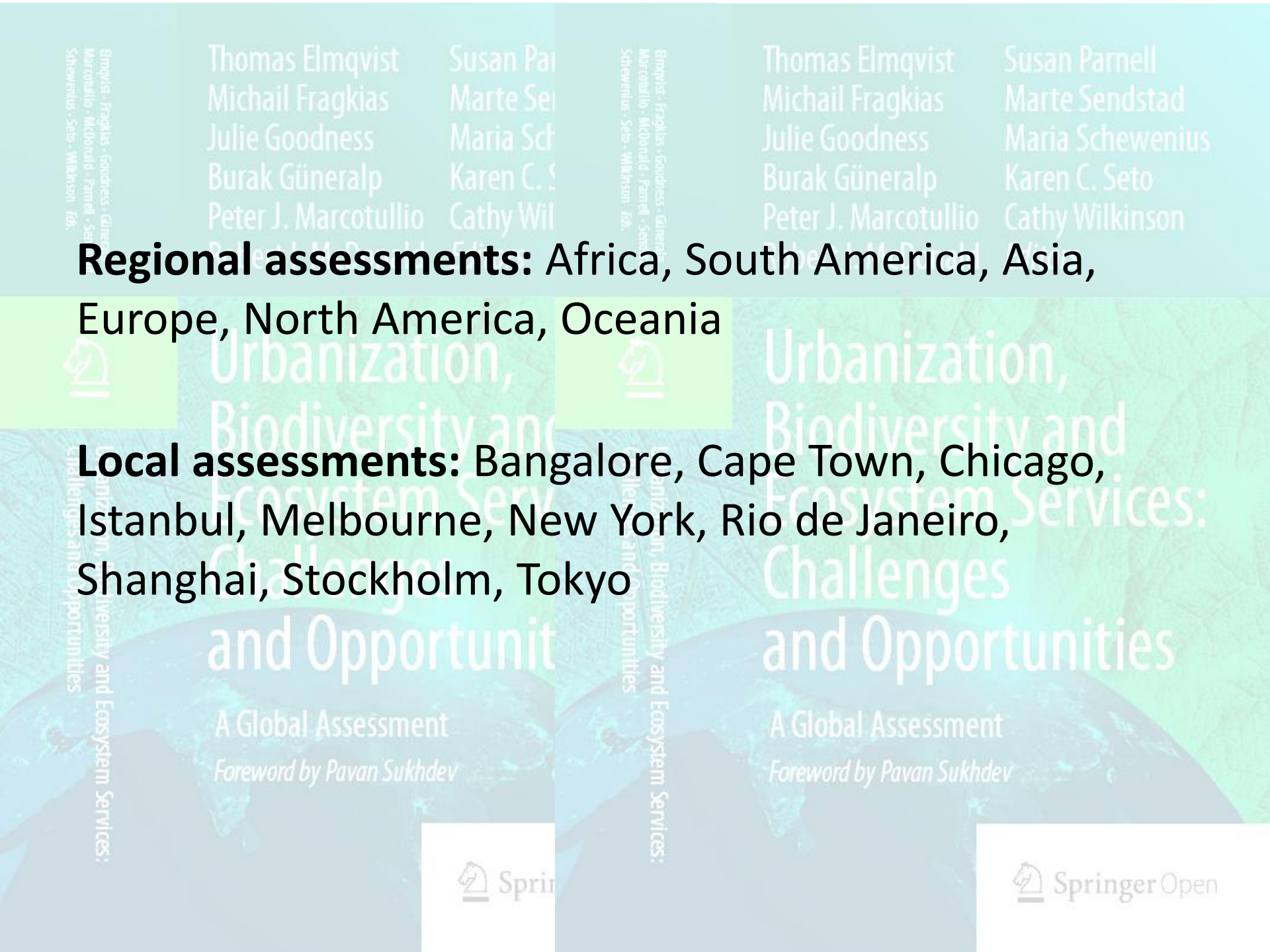
Shrinking Cities, Biodiversity and Ecosystem Services
Dagmar Haase

Climate Change and Urban Biodiversity Vulnerability
William Solecki and Peter J. Marcotullio

Feeding Cities: Food Security and Ecosystem Support in an Urbanizing World
Lisa Deutsch, Robert Dyball, and Will Steffen

Urban Governance of Biodiversity and Ecosystem Services
Cathy Wilkinson, Marte Sendstad, Susan Parnell, and Maria Schewenius

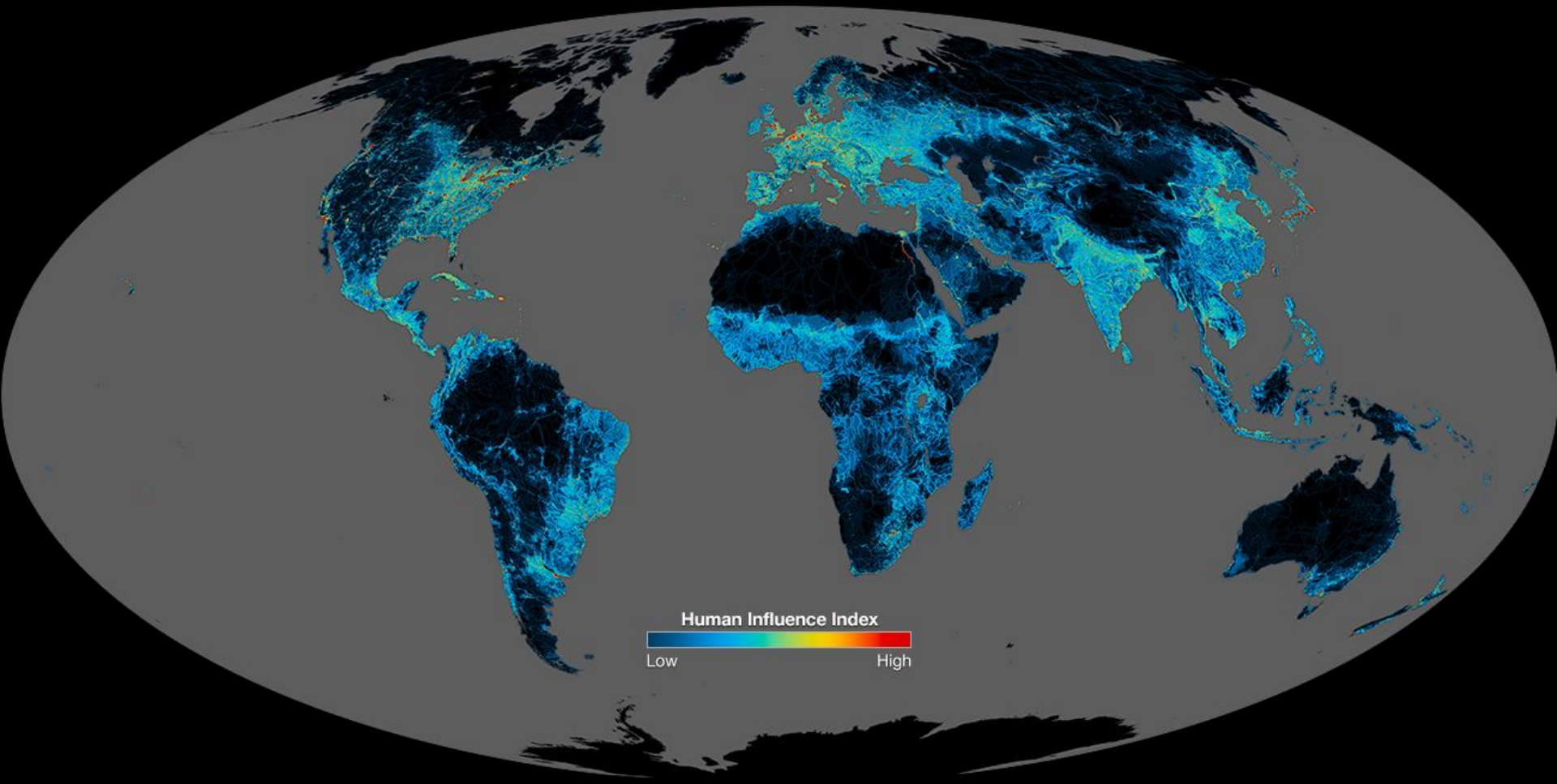
Restoration Ecology in an Urbanizing World
Steven N. Handel, Osamu Saito, and Kazuhiko Takeuchi



Regional assessments: Africa, South America, Asia, Europe, North America, Oceania

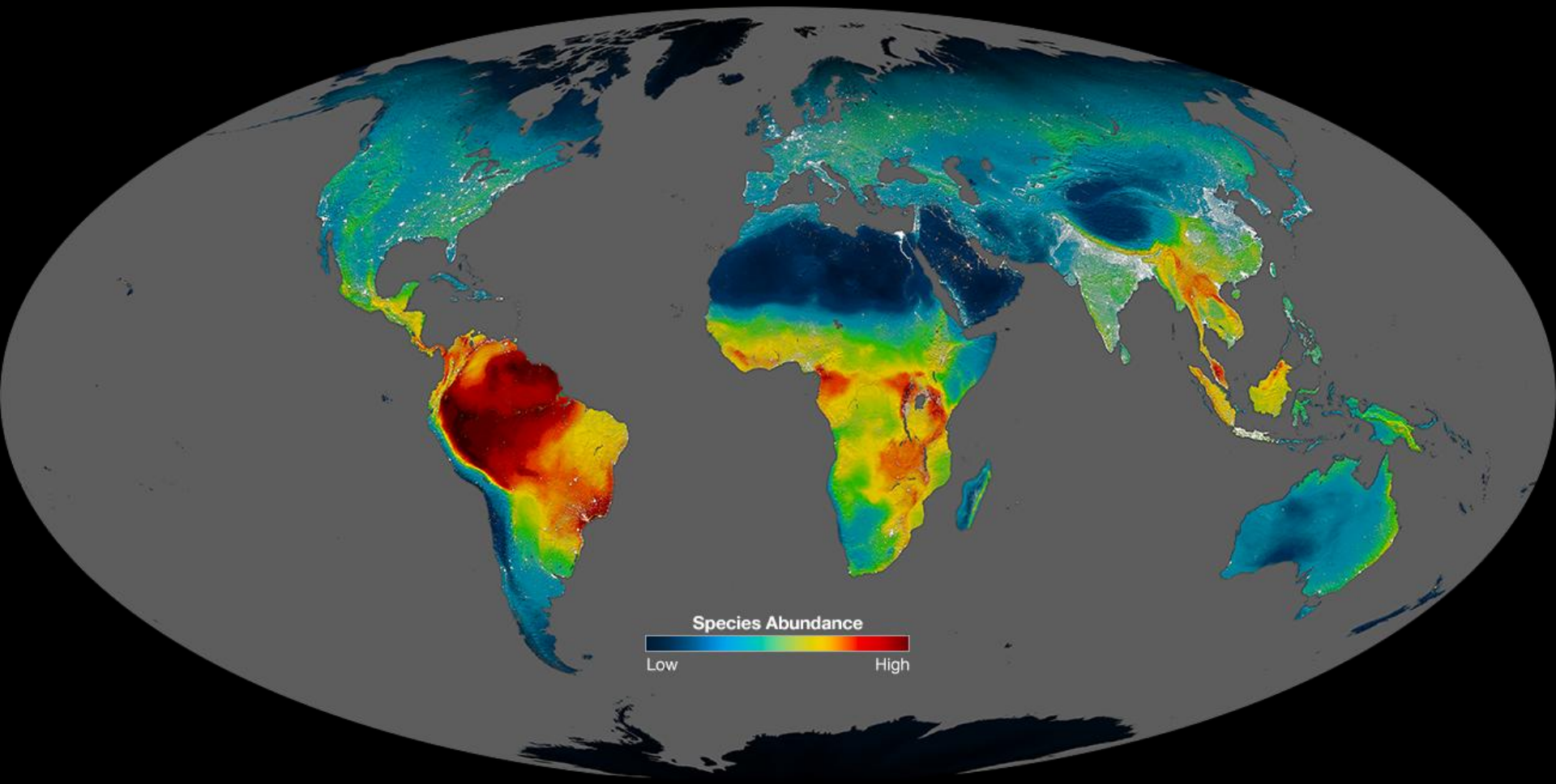
Local assessments: Bangalore, Cape Town, Chicago, Istanbul, Melbourne, New York, Rio de Janeiro, Shanghai, Stockholm, Tokyo

The Anthropocene



The Human Influence Index (HII) measure direct human influence on terrestrial ecosystems (population density, built-up areas), access (roads, railroads, navigable rivers, coastline), landscape transformation (landuse/landcover) and electric power infrastructure (nighttime lights) Source: NASA

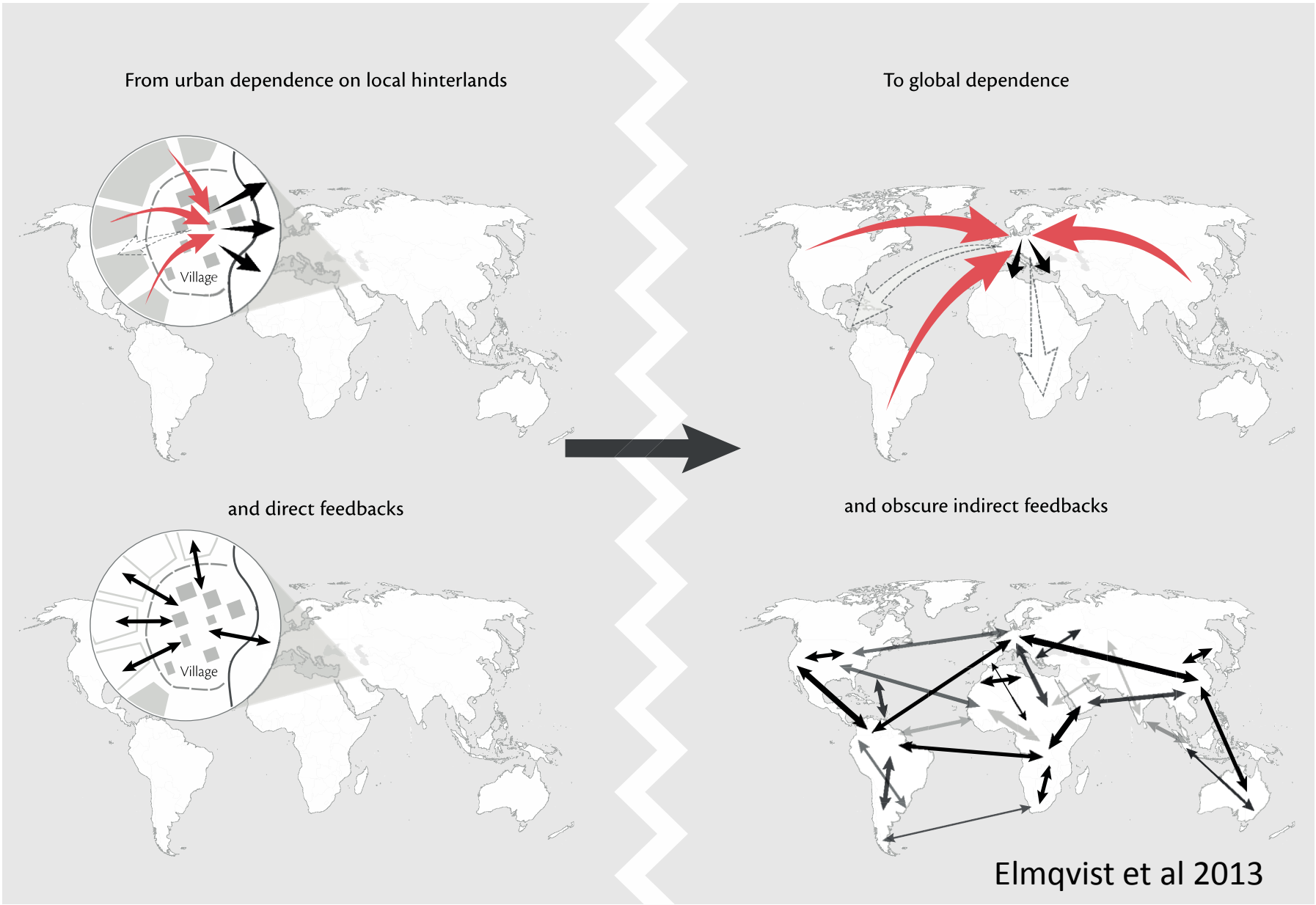
Centers of richness for mammals, amphibians and birds



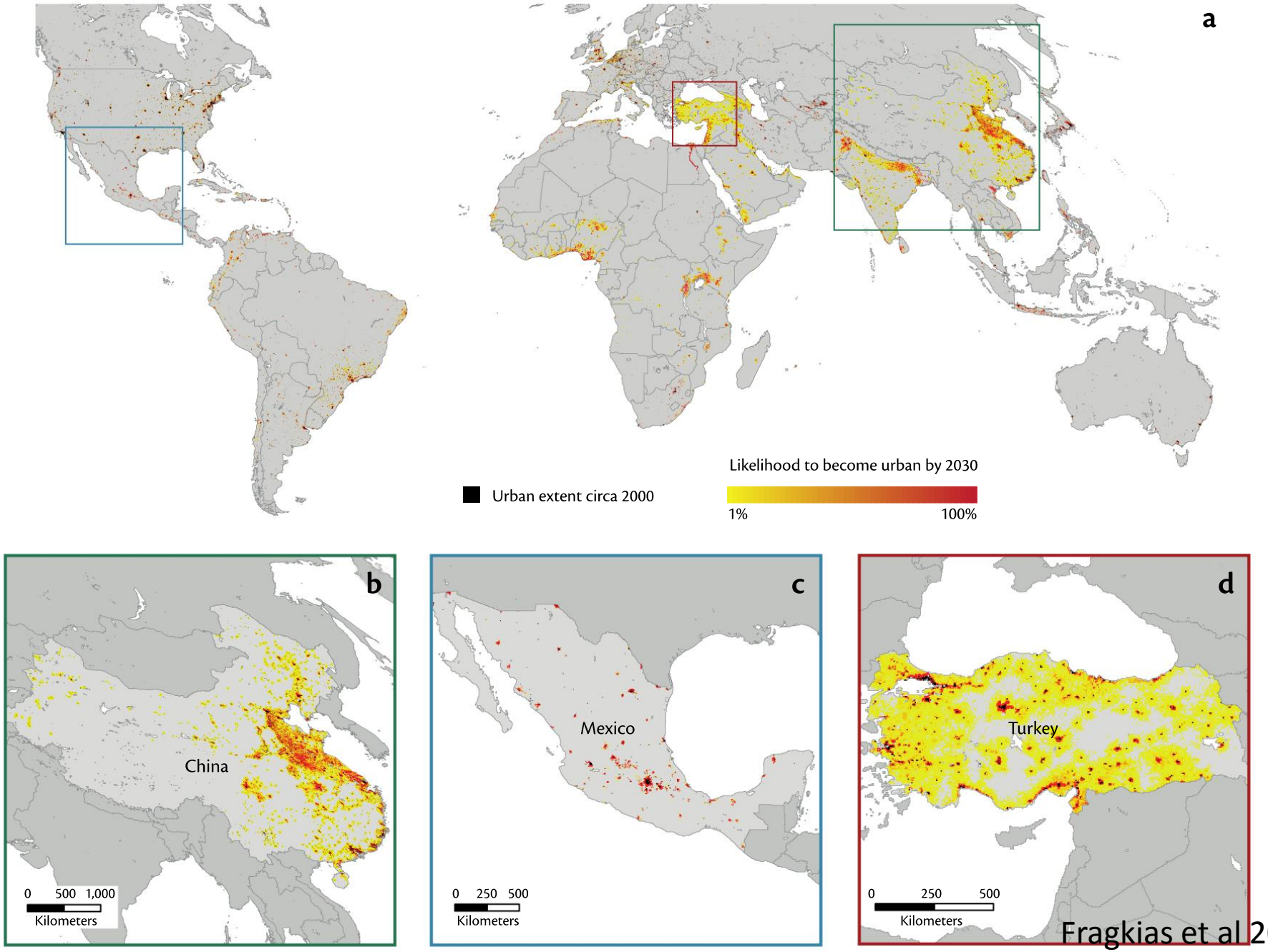
Source: International Union for the Conservation of Nature.

The Urbanized Planet

From simple to very complex resource dependence, impacts and feedbacks



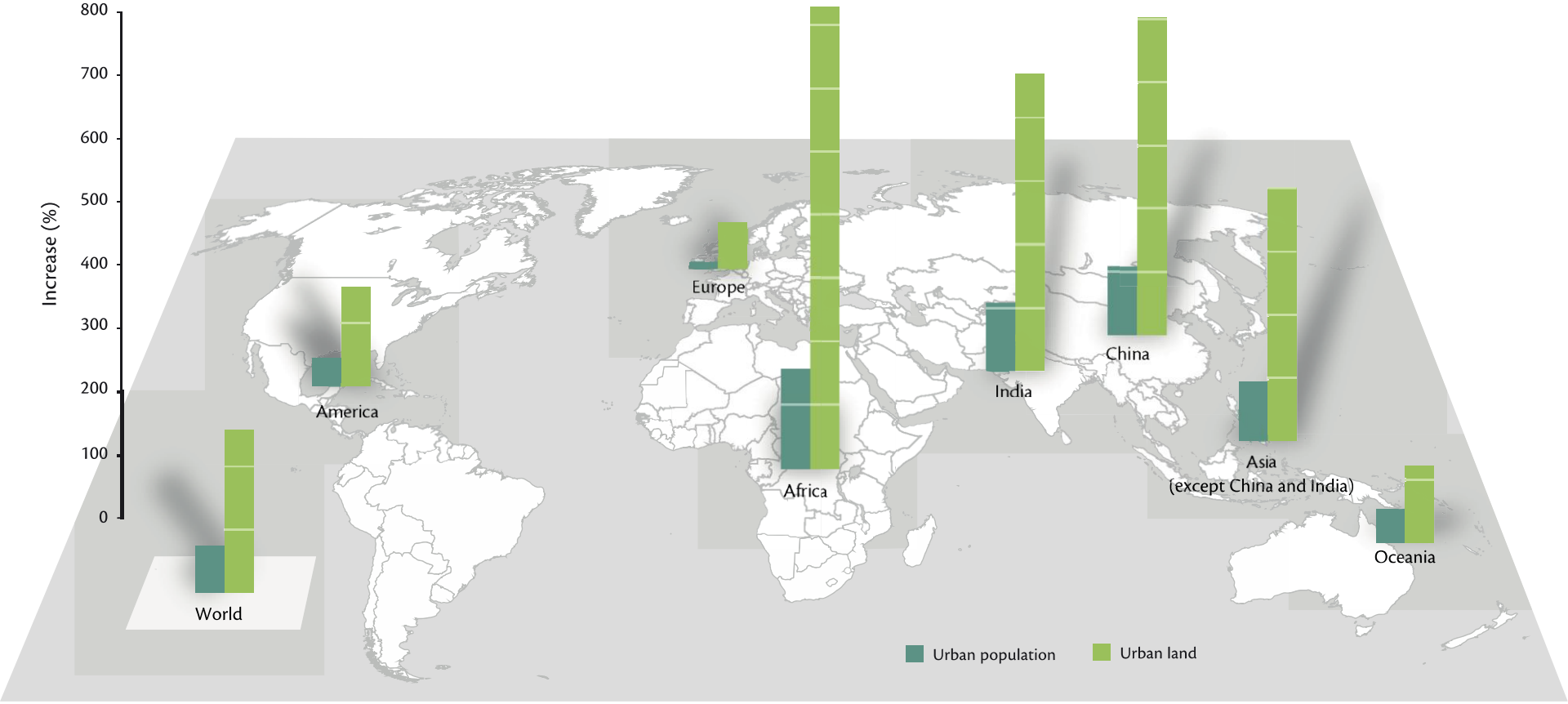
Different patterns of urbanization



Fragkias et al 2013

Fig. 12.1 Shrinking cities faced with population losses worldwide (Reproduced from Oswalt and Rieniets 2006. Published with kind permission of © Hatje Cantz Publishers 2006. All Rights Reserved)

Rates of development or urban land area and urban population size (2000-2030)



Fragkias et al 2013

Uneven Distribution of Knowledge

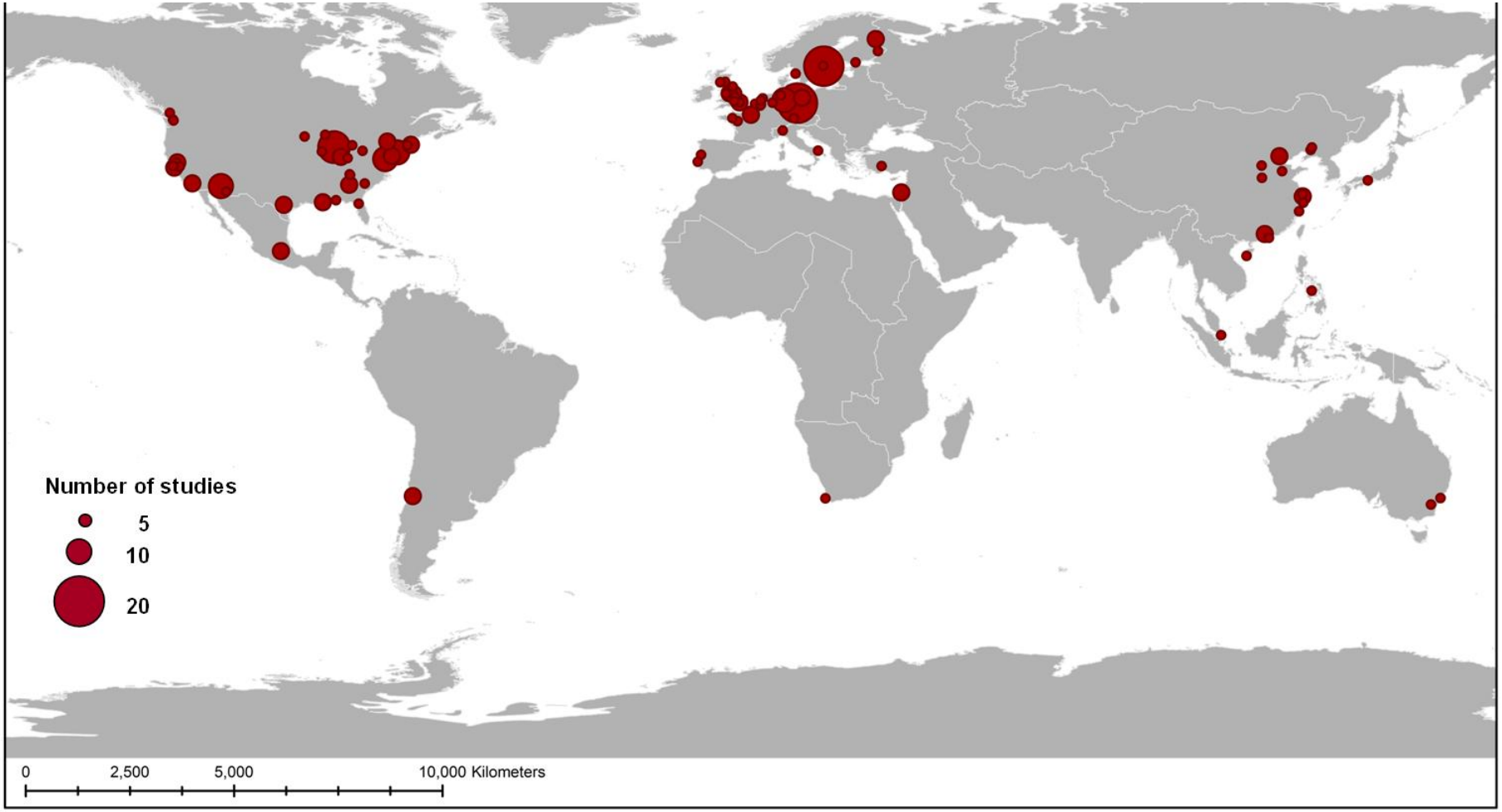
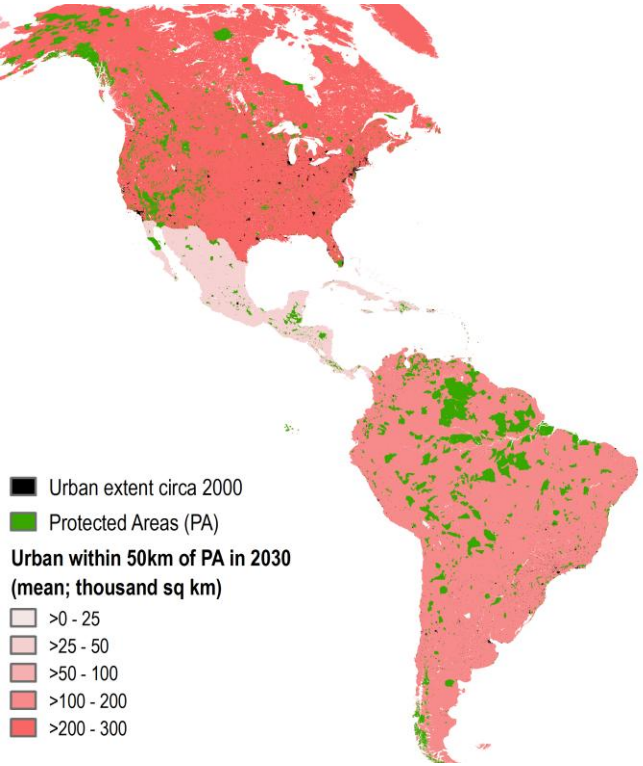
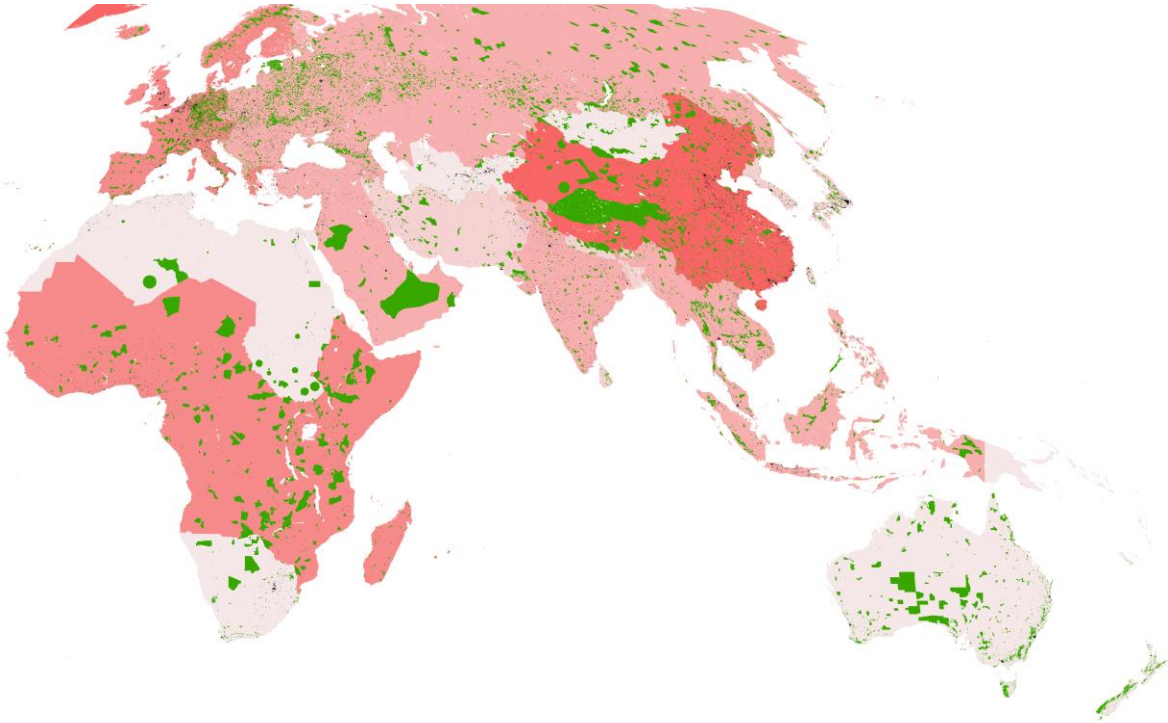


Fig. 33.1 The distribution of 217 urban ecosystem services case studies appearing in peer-reviewed literature during the period 2000–2012 (Reproduced from Haase et al. 2014, submitted. Published with kind permission of © Dagmar Haase 2014. All Rights Reserved)

Urban Biodiversity and Ecosystem Services Challenges and opportunities

Urbanization and protected areas

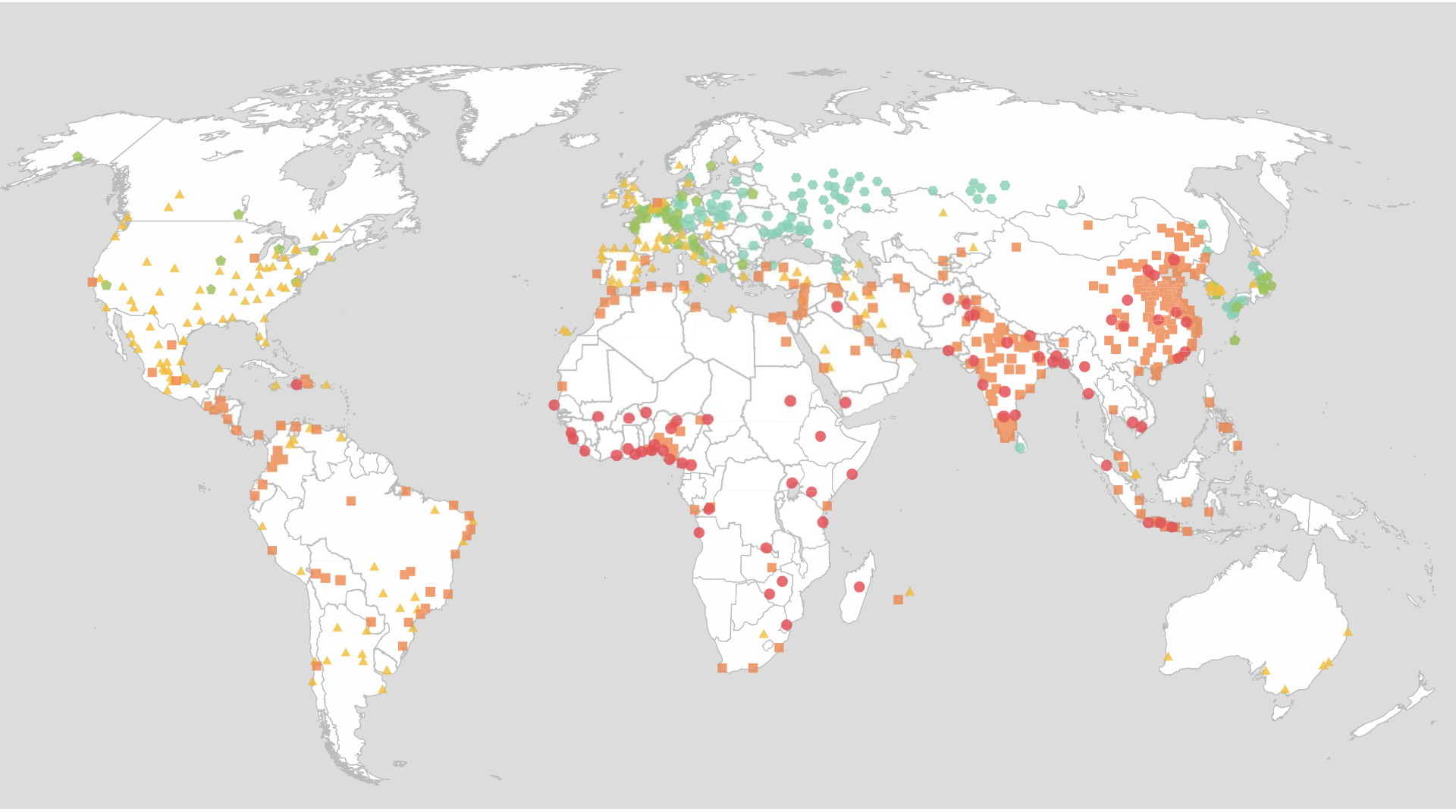




Today 25% of the world's protected areas are within 17 km of an urban area - in 10 years 15 km

Gulnerap et al 2013

Capacity to deliver water



McDonald and Marcotullio 2013

CHALLENGES & OPPORTUNITIES

MORE THAN **60%** OF THE AREA PROJECTED TO BE **URBAN** IN **2030**
HAS YET TO BE **BUILT**

Urbanization and Climate Change: Challenges and opportunities

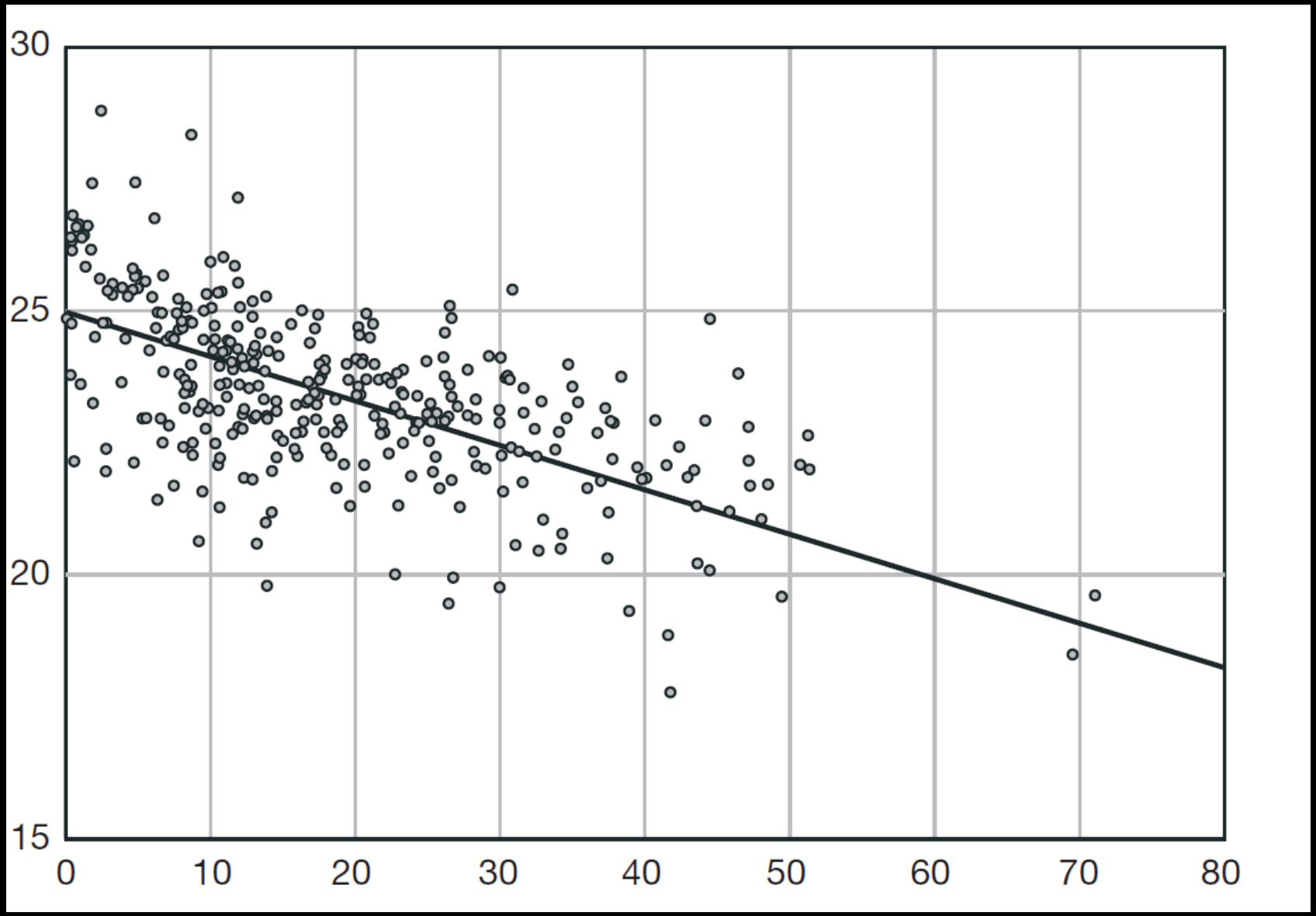
Projected impacts on urban areas of changes in extreme weather and climate events (modified from IPCC 2007 and updated based on IPCC WGI 2013).

Climate phenomena	**Likelihood** Early 21st century	Late 21st century	**Projected impacts in urban regions.**	**Vulnerability factors in Developing countries**
More frequent hot days and nights, warm spells and heat waves.	*Very likely*	*Virt. certain*	Increased demand for cooling. Declining air quality. Heat and respiratory stresses. Impact on elderly, very young and poor.	Existing disease burden is high and predisposes people to heat and respiratory stresses. Limited access to cooling and refrigeration.
Increased frequency of heavy precipitation events.	*Likely*	*Very likely*	Disruption of settlements, commerce and transport, loss of property due to flooding.	Insecure tenure, leads to conflict and marginalization of the poor. Natural vegetation buffers denuded. Lack of flood mitigation infrastructure and resources.
Increased incidence and/or magnitude of high sea level	*Likely*	*Very likely*	Disruption of settlements, commerce and transport, loss of property	Translocations, abandonment of property
Increase in tropical cyclone activity	*Likely in some regions*	*More likely than not*	Damage of property in cities, disruption of public water supply and services.	Poorly constructed infrastructure prone to flood and cyclone damage. Inadequate disaster relief services and low levels of formal insurance.

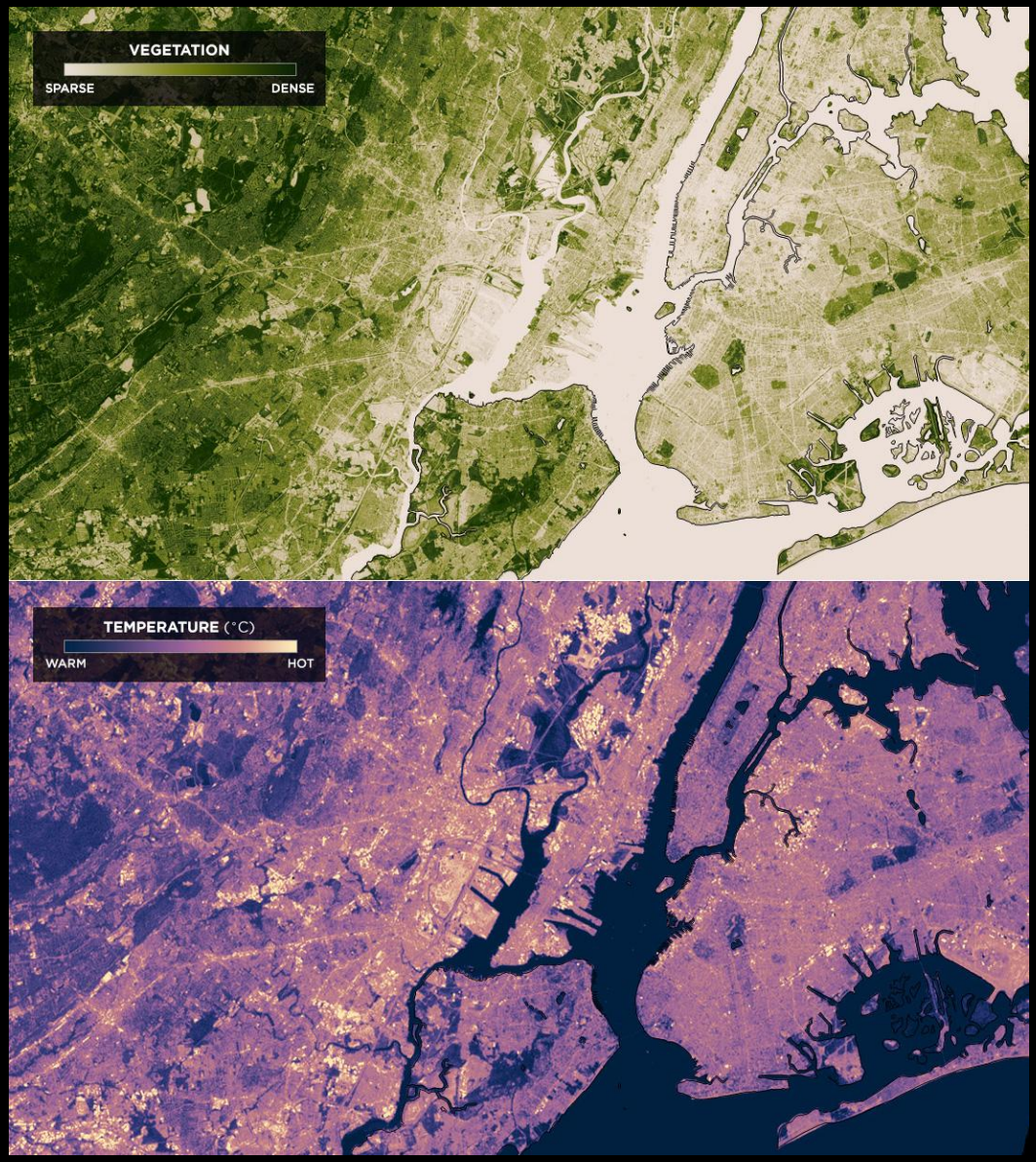
Urban heat waves

Estimated 70.000 excess deaths as a result of a heat wave in Europe in 2003 (Robine et al 2007)

Cooling effect of trees



Saatchi et al 2010

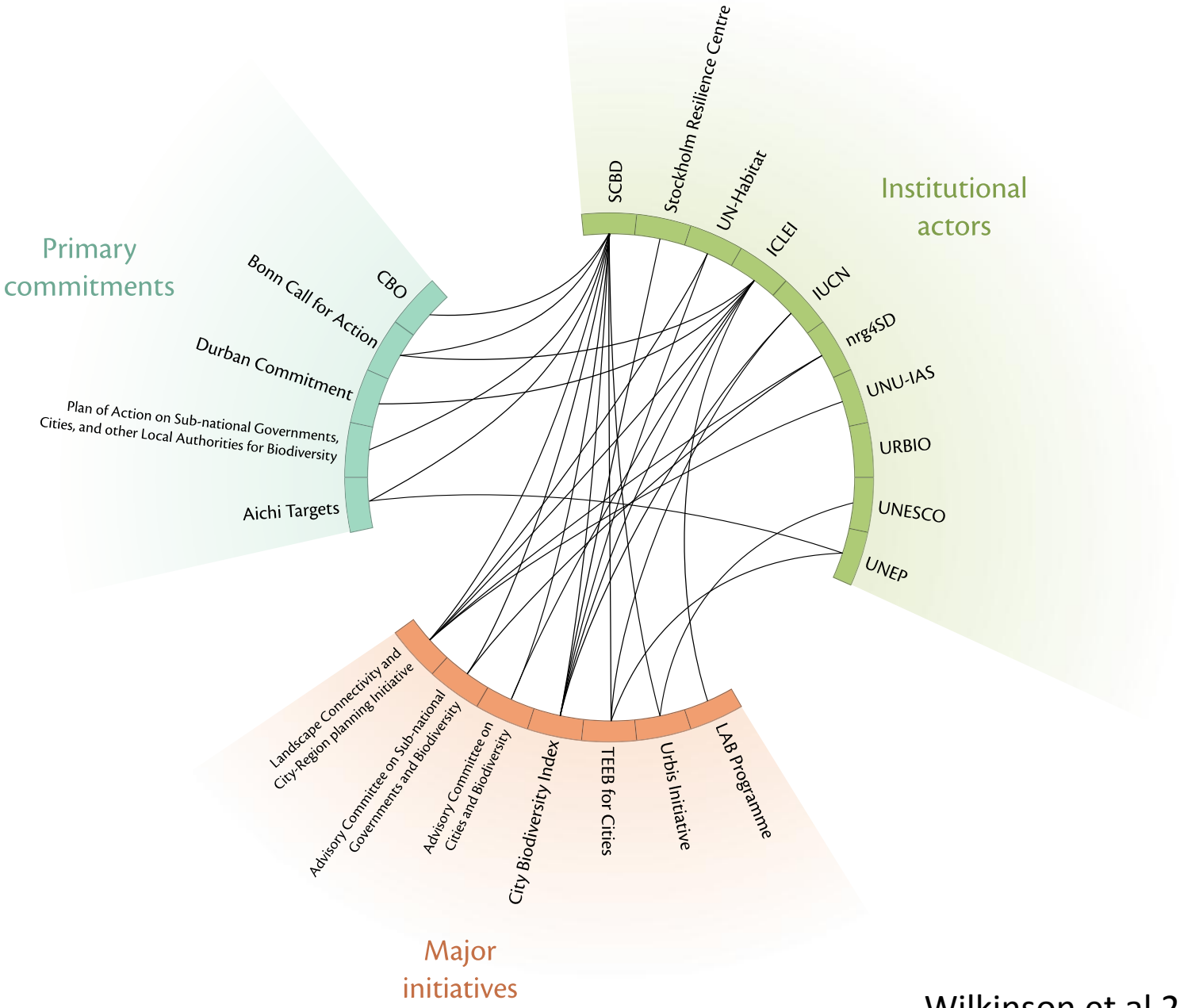


Urban heat island in New York City.

Multiple Benefits of Urban Trees

Elmqvist et al 2013

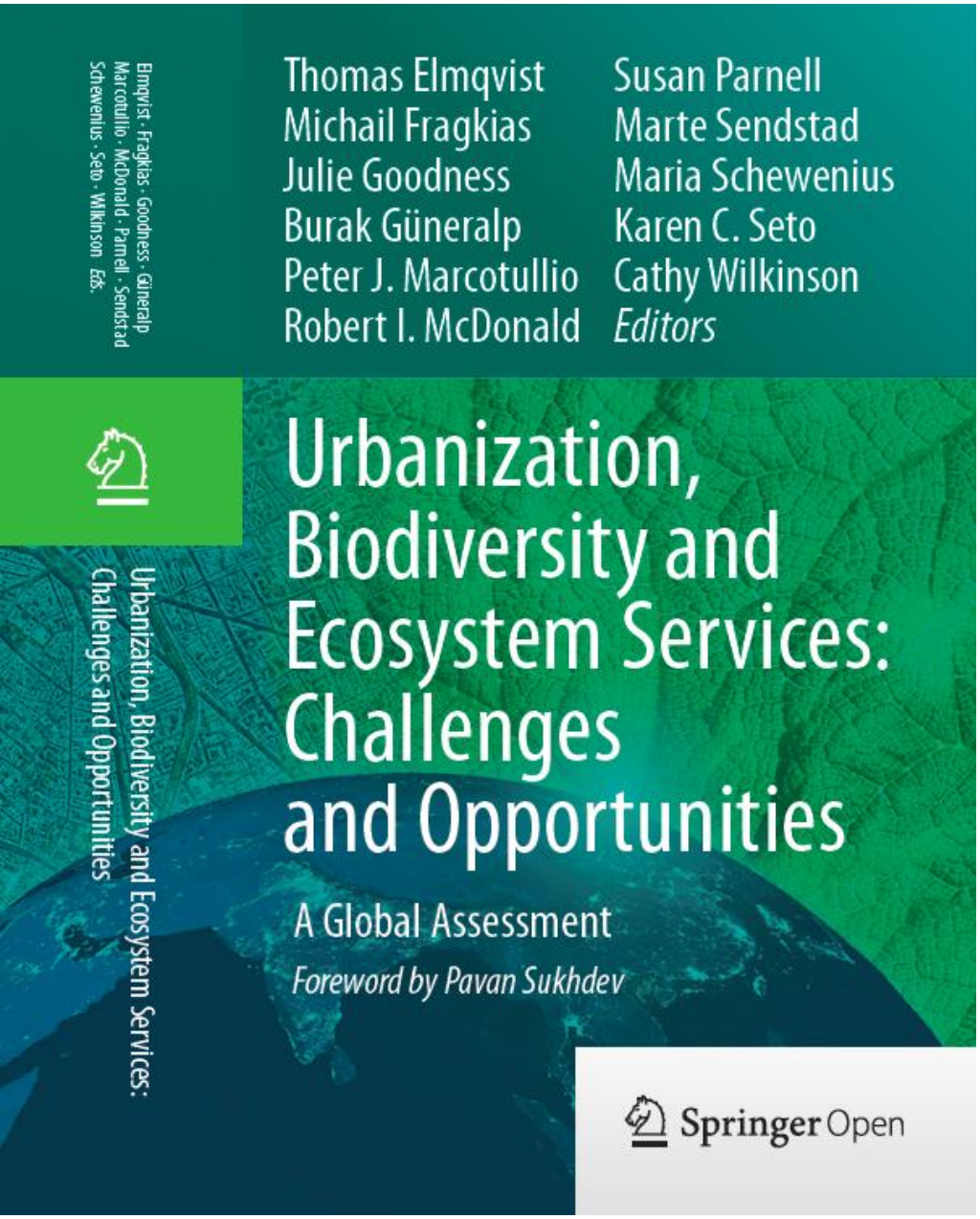
Urbanization, Biodiversity and Ecosystem services



Wilkinson et al 2013

Stewardship of the Biosphere in the Urban Era

Thomas Elmqvist, Michail Fragkias, Julie Goodness, Burak Güneralp, Peter J. Marcotullio, Robert I. McDonald, Susan Parnell, Maria Schewenius, Marte Sendstad, Karen C. Seto, Cathy Wilkinson, Marina Alberti, Carl Folke, Niki Frantzeskaki, Dagmar Haase, Madhusudan Katti, Harini Nagendra, Jari Niemelä, Steward T.A. Pickett, Charles L. Redman, and Keith Tidball



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Convention on Biological Diversity

UN HABITAT

formas

DIVERSITAS
an international programme of biodiversity science

The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning

GLOBAÏA

ICLEI
Local Governments for Sustainability

UNESCO
United Nations Educational, Scientific and Cultural Organization

biodiversa

Japan Biodiversity Fund