

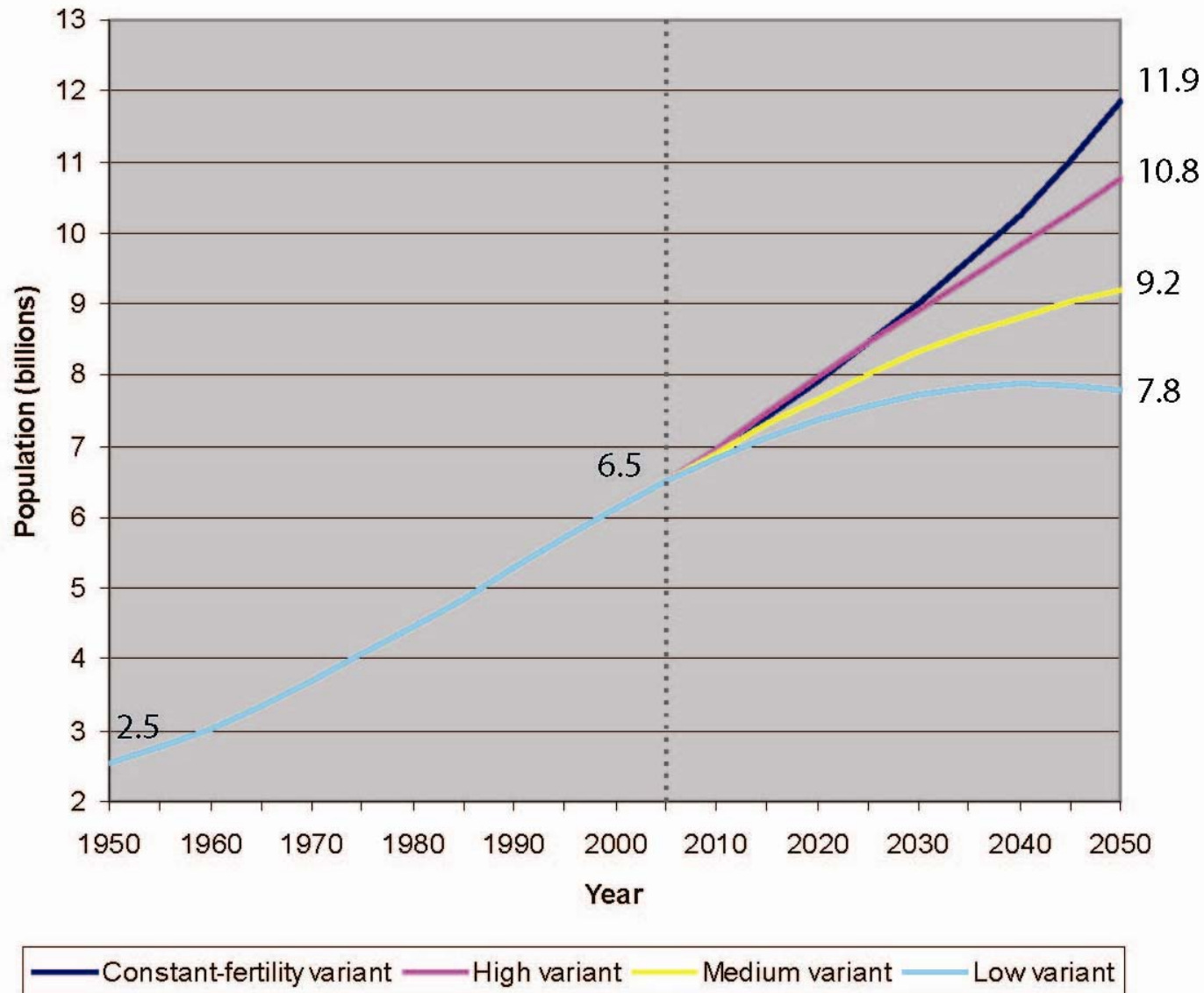
From Local to Global Patterns of Urban Land-Use Change: What We Know and Don't Know

Karen C. Seto

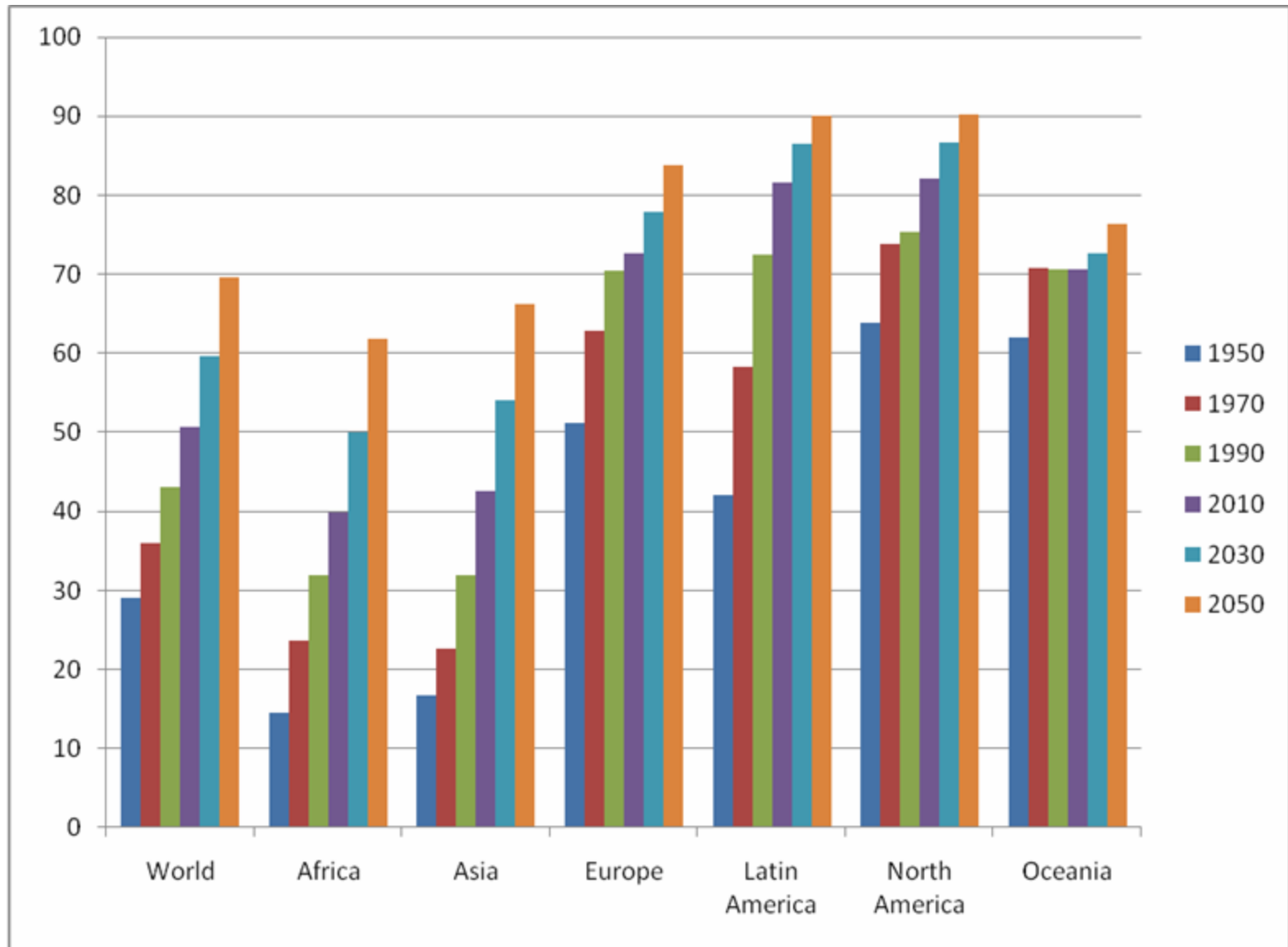
Associate Professor
School of Forestry & Environmental Studies
Yale University

Co-Chair
IHDP Project on
Urbanization and Global Environmental Change

Global Population Projections and Uncertainty



Urban Population By Region



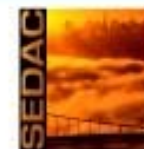
The World: Urban Extents of Settlements greater than 5000



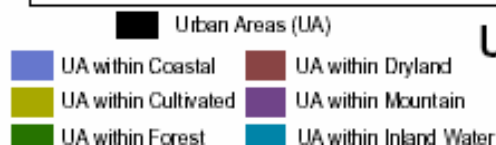
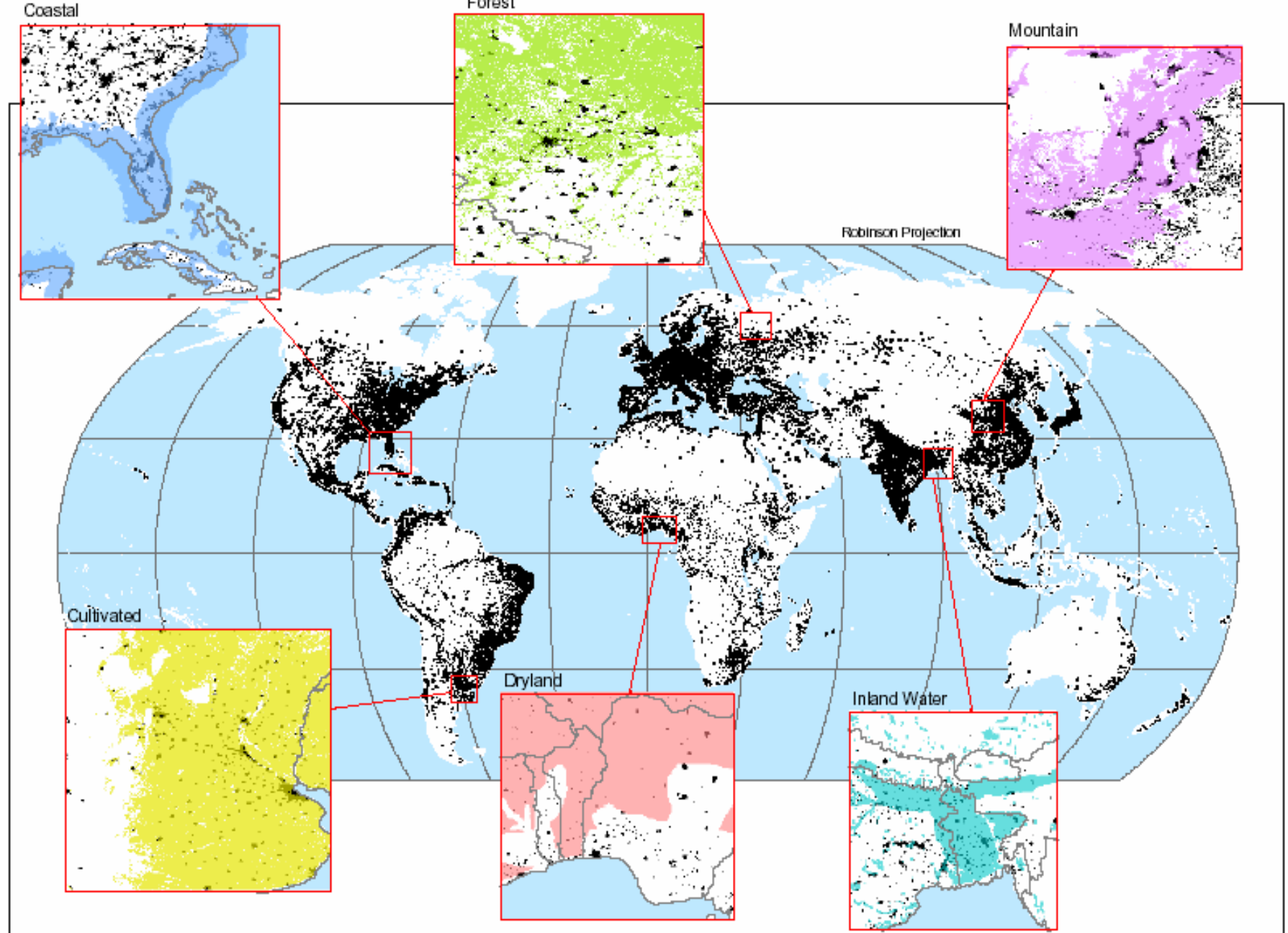
Robinson Projection

Urban-Rural Extents

- Urban areas
- National Boundary



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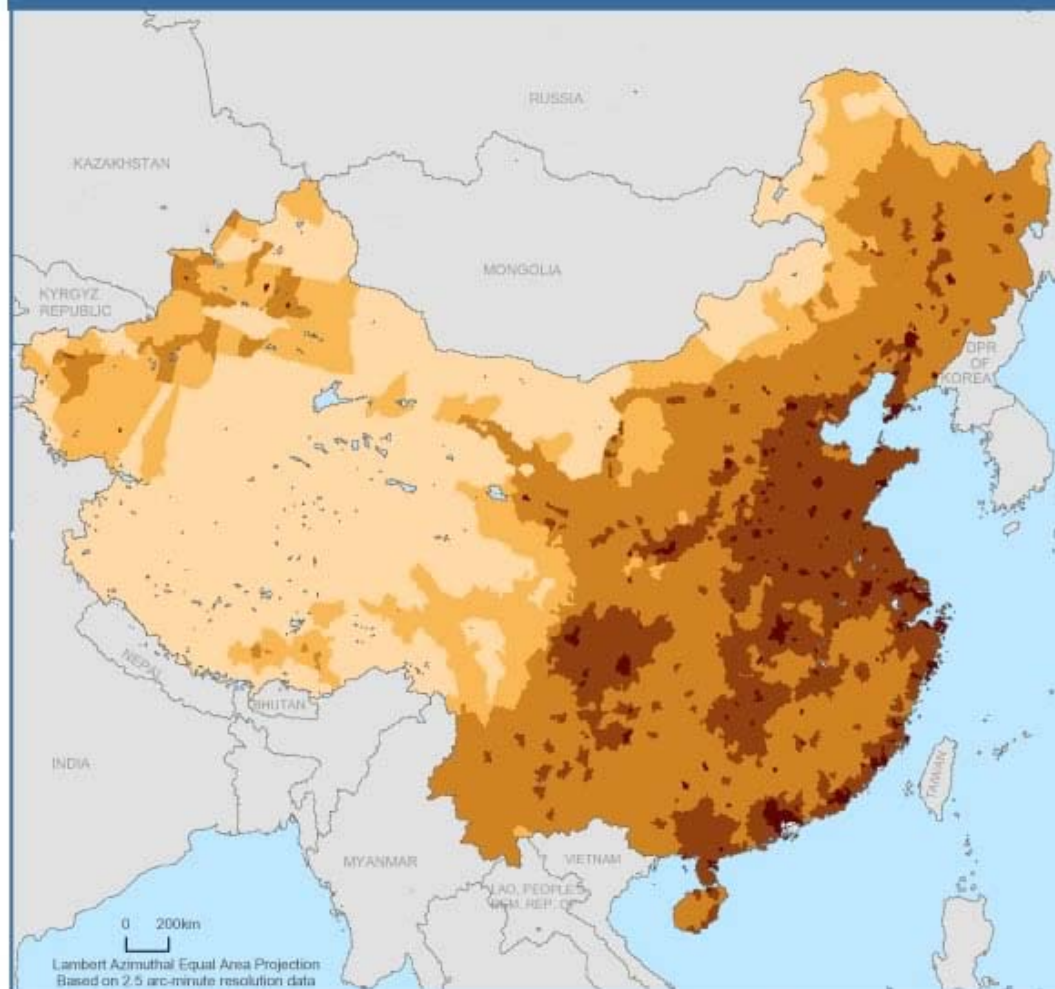
Urban Extents: Settlements Greater Than 5000 Persons

Call-outs show urban areas overlaid by ecosystems.

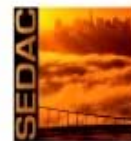
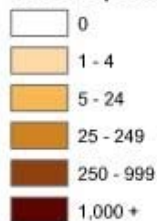
NOTE: Urban areas not drawn to scale. They are boldlined here so as to be visible on unprinted maps. Refer to Table 10.4 for estimates of urban land area.

Data Sources: Global Rural-Urban Mapping Project version 1,
Millennium Ecosystem Assessment core database
<http://www.rush.columbia.edu>



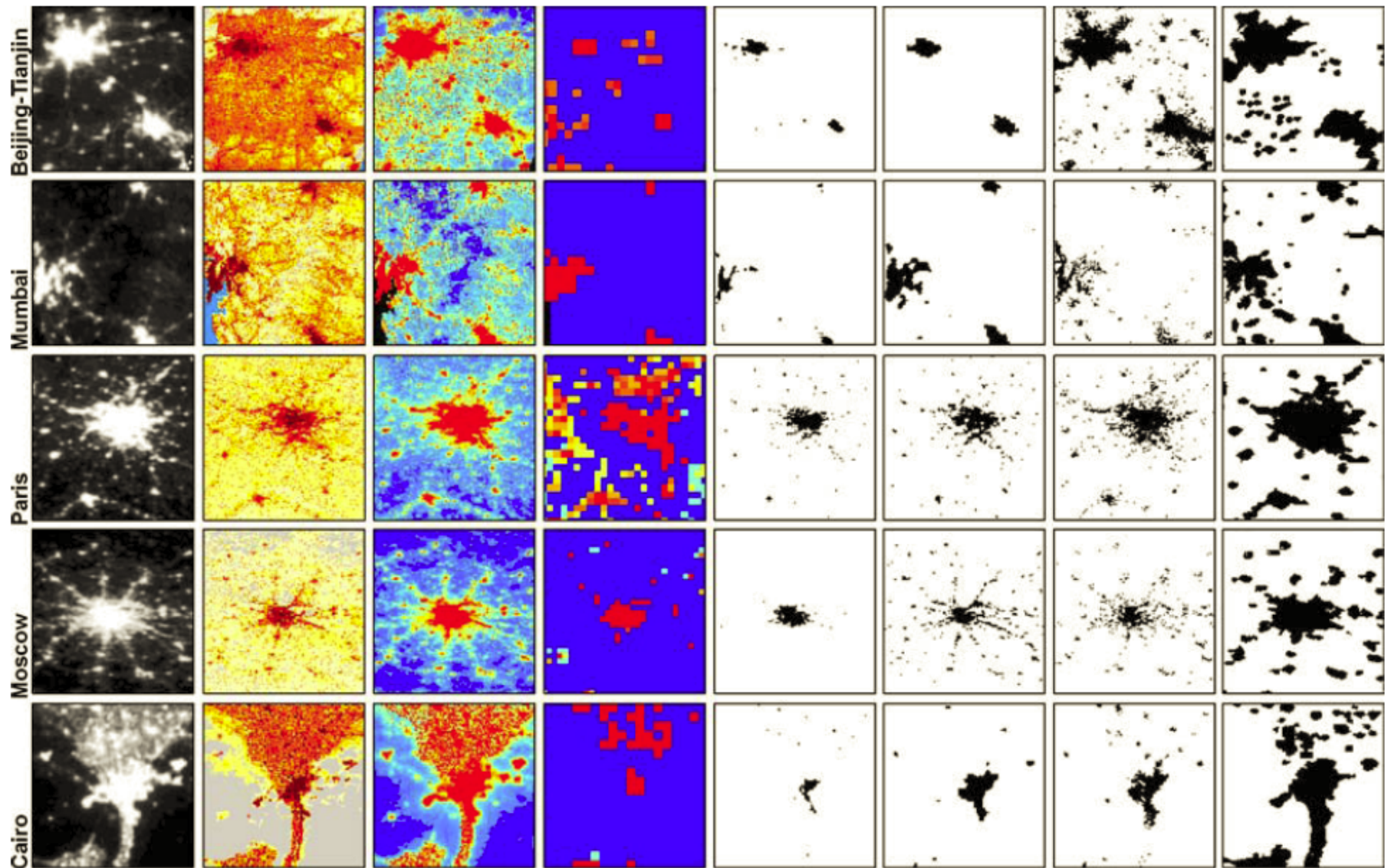


Gridded Population of the World

Persons per km²

Copyright 2005, The Trustees of Columbia University in the City of New York.
Source: Center for International Earth Science Information Network (CIESIN),
Columbia University; and Centro Internacional de Agricultura Tropical (CIAT),
Gridded Population of the World (GPW), Version 3, Palisades, NY: CIESIN,
Columbia University. Available at: <http://sedac.ciesin.columbia.edu/gpw>.

NOTE: National boundaries are derived from the population grids and thus
may appear coarse.



Night Lights
(LITES)

LandScan 2005
(LSCAN)

Imp. Surf. Area
(IMPISA)

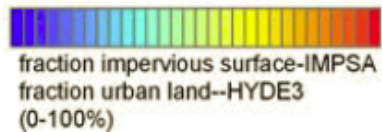
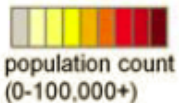
HYDE v3
(HYDE3)

VMAP Level 0
(VMAP0)

GLC 2000
(GLC00)

MODIS LC
(MODIS)

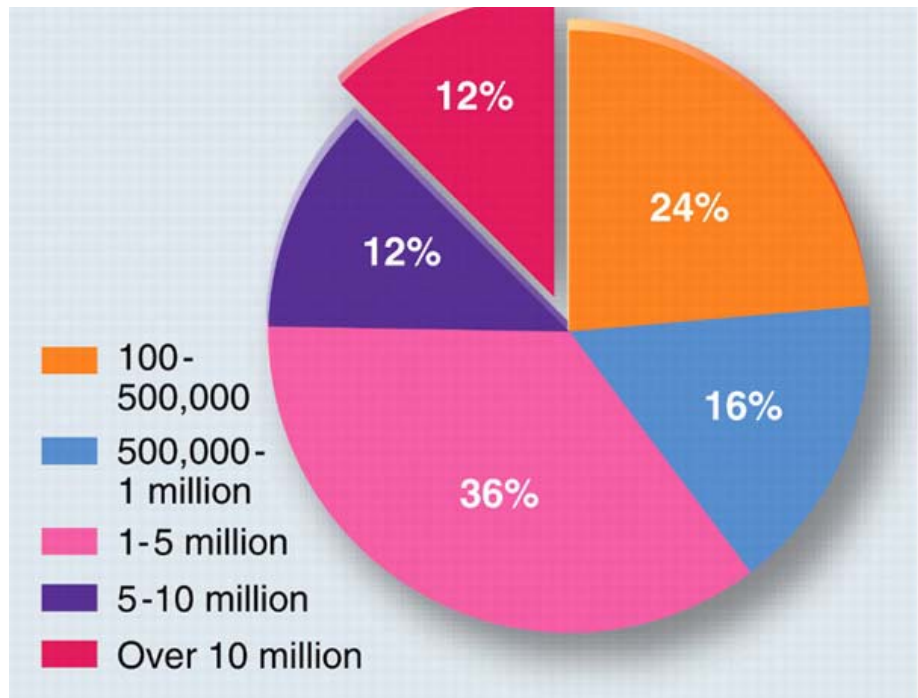
GRUMP



(Potere and Schneider, 2008)

Urbanization as a land versus demographic process

- UN estimates of urban population, but not urban land-use change
- Very little understanding of global rates and patterns of urban land-use change
- *How and where* have urban areas expanded historically?
- *How and where* will urban areas expand in the future?



At Local Scales, One Common Theme





Photo: Shenzhen Planning Bureau

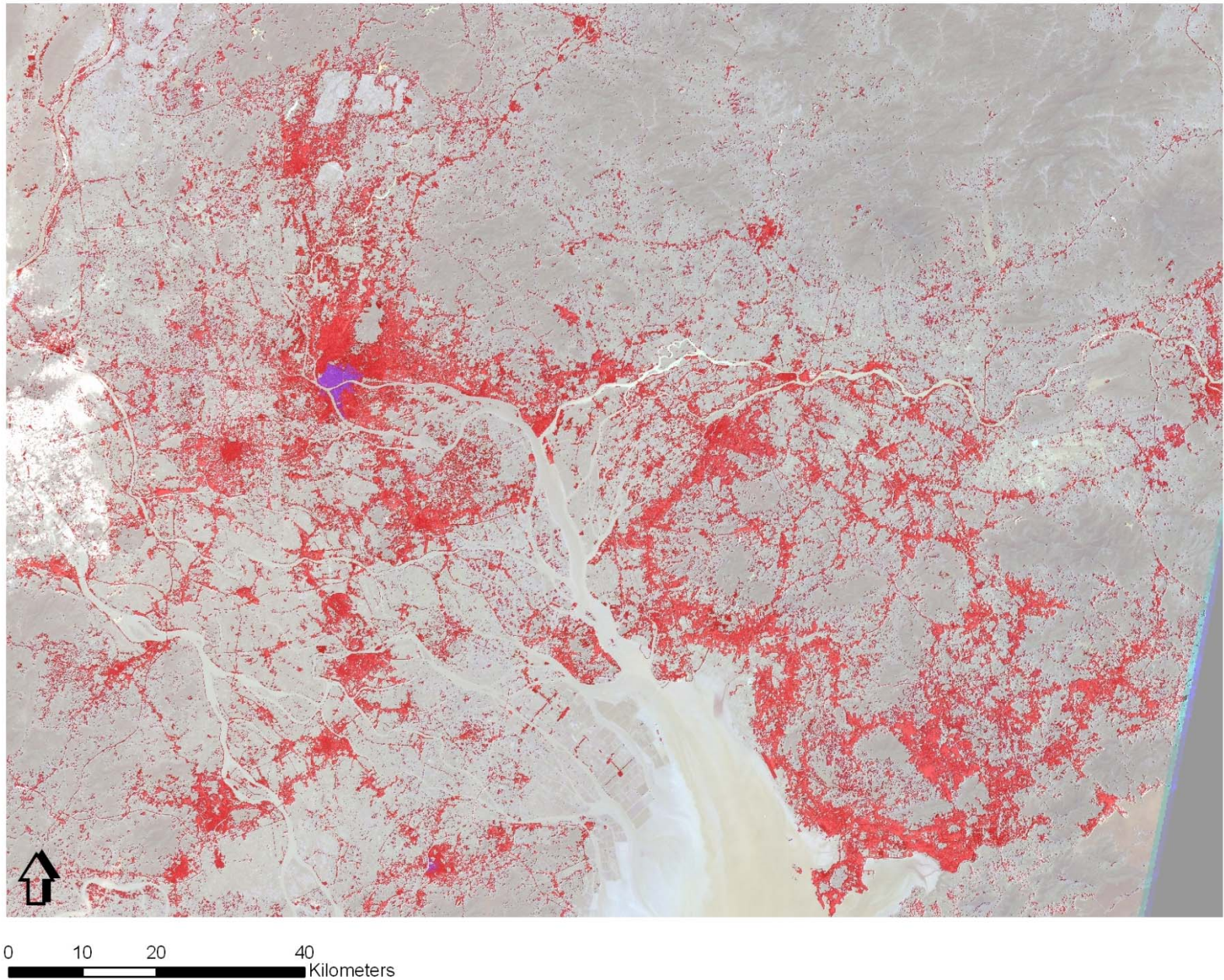


Photo: Shenzhen Planning Bureau



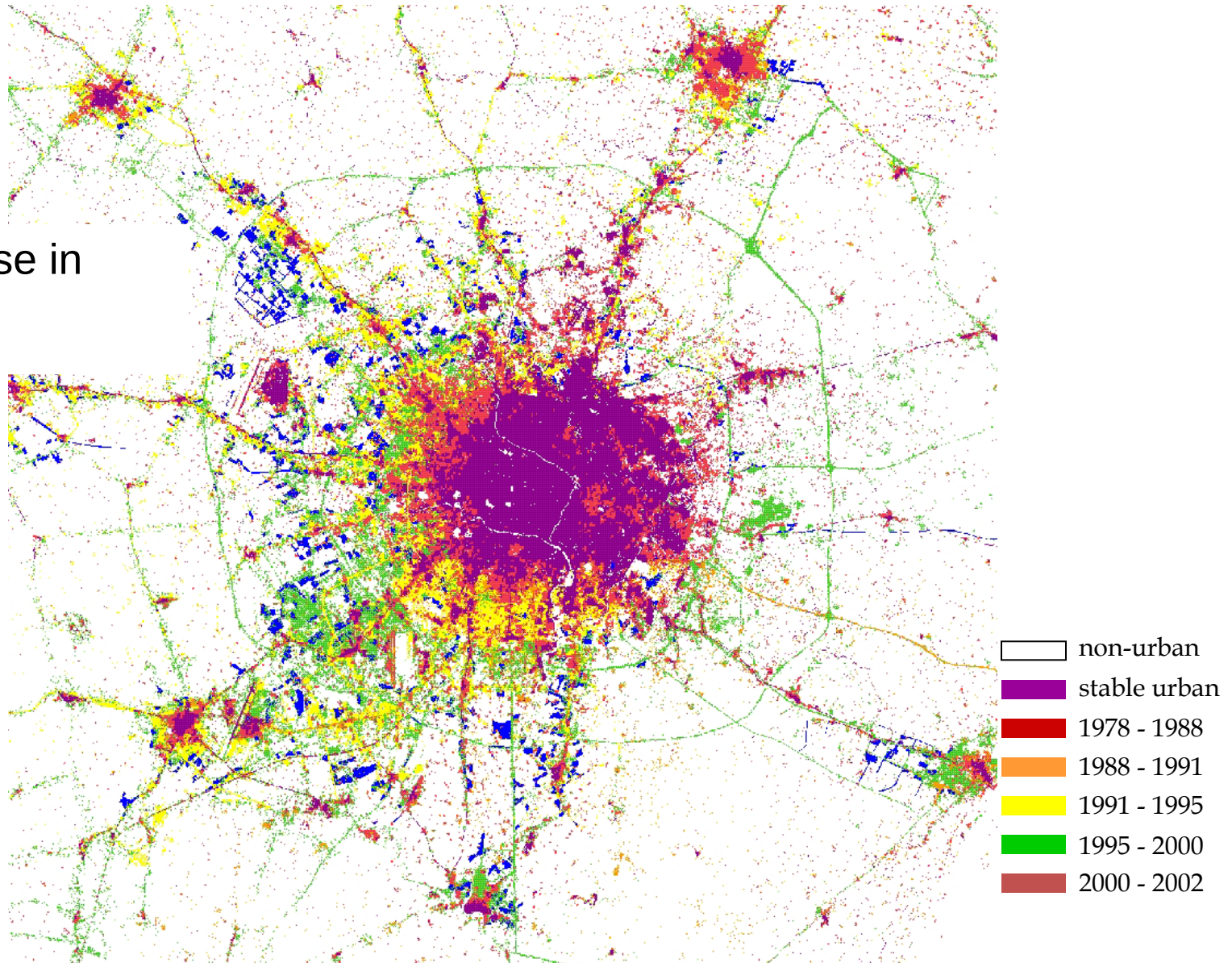


Urban Growth in Pearl River Delta, China - 1999



Urban Growth in Chengdu

300% increase in
urban land



Urban Growth in Doha, Qatar - 1973 to 2007

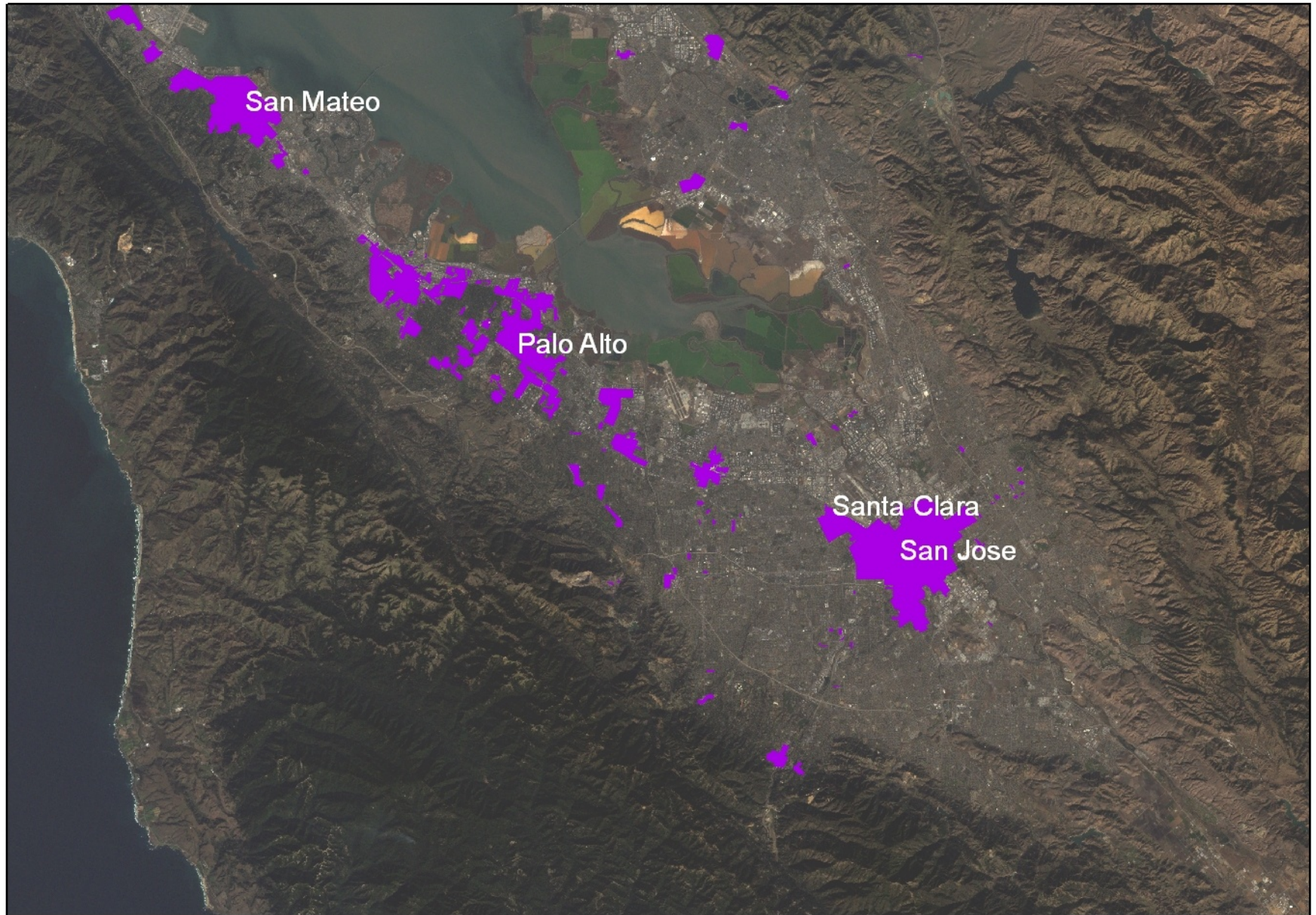


0 2 4 8 Kilometers

Non Urban
Stable Mixed Urban
1973 - 1988
1988 - 1990

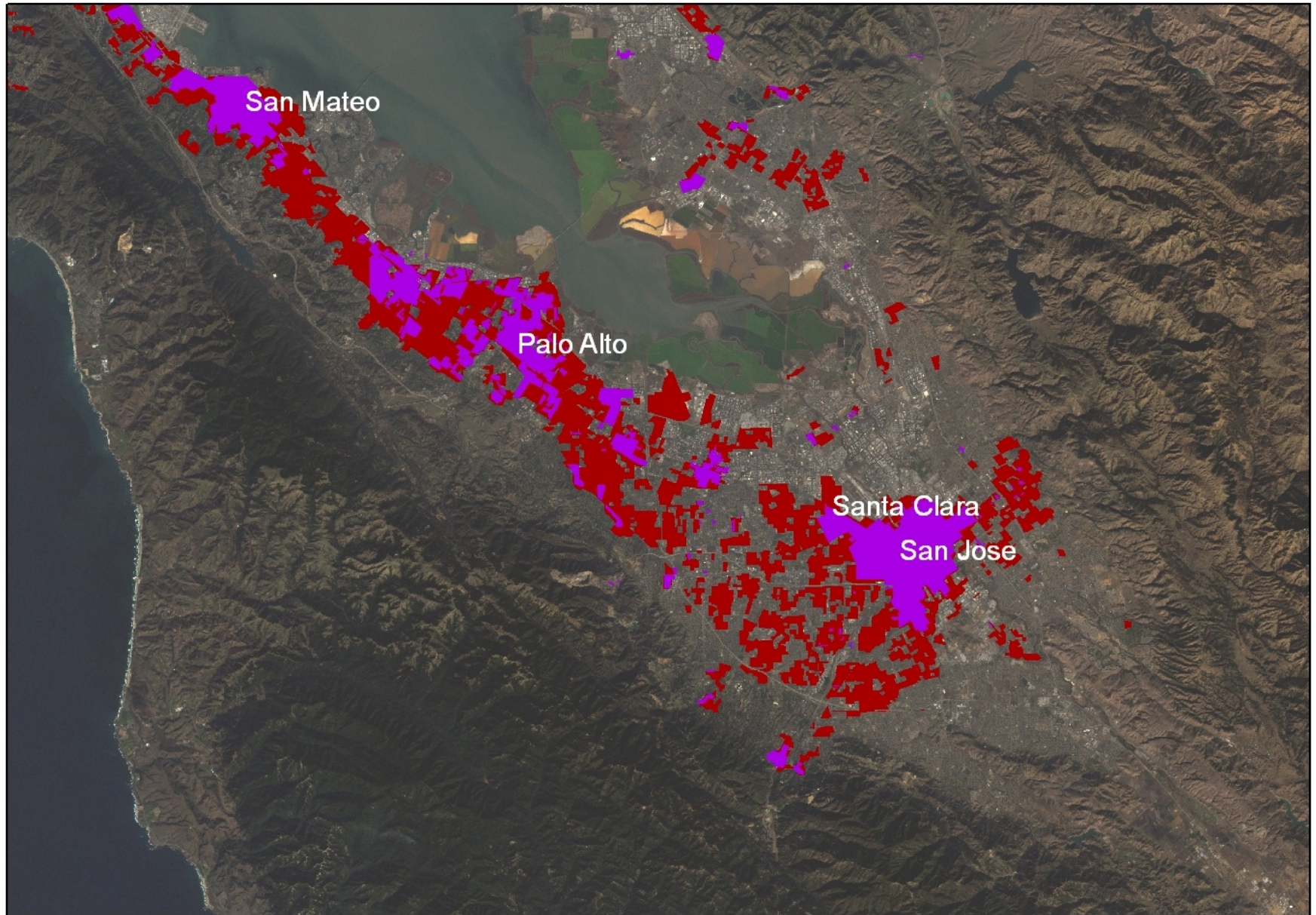
1990 - 2000
2000 - 2004
2004 - 2007

Urban Growth in the Silicon Valley: 1948



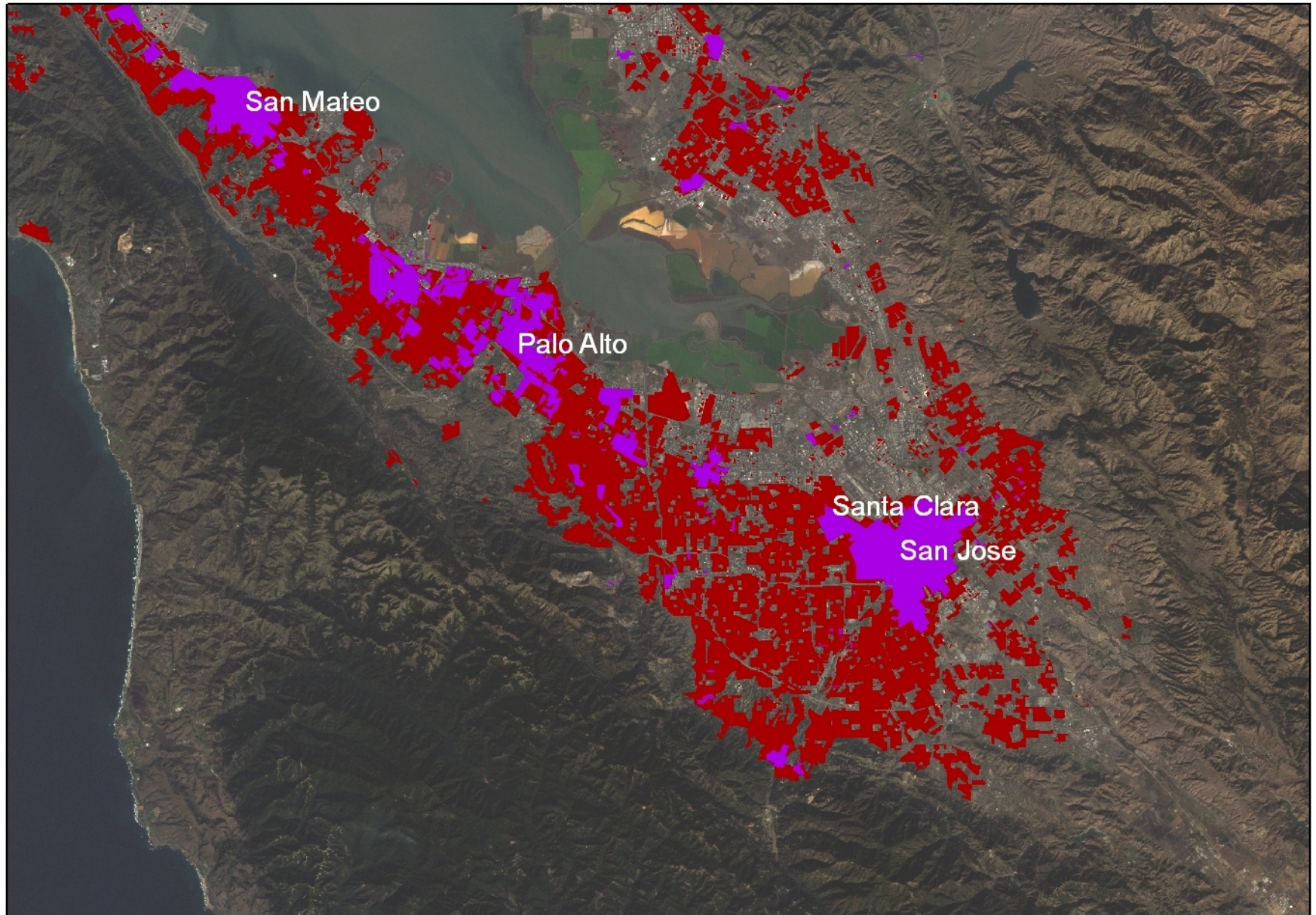
0 5 10 20 Kilometers

Urban Growth in the Silicon Valley: 1961



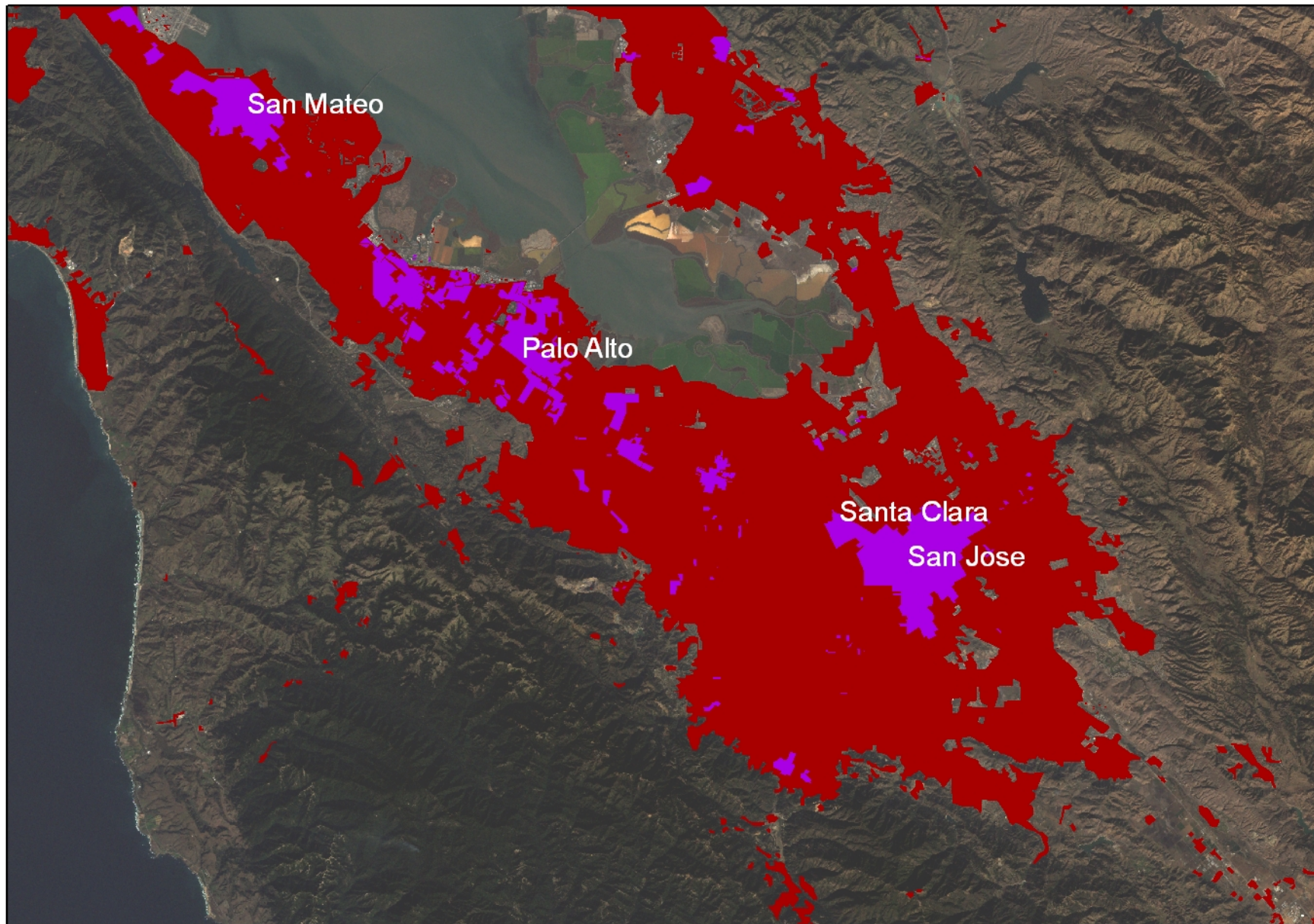
0 5 10 20 Kilometers

Urban Growth in the Silicon Valley: 1972



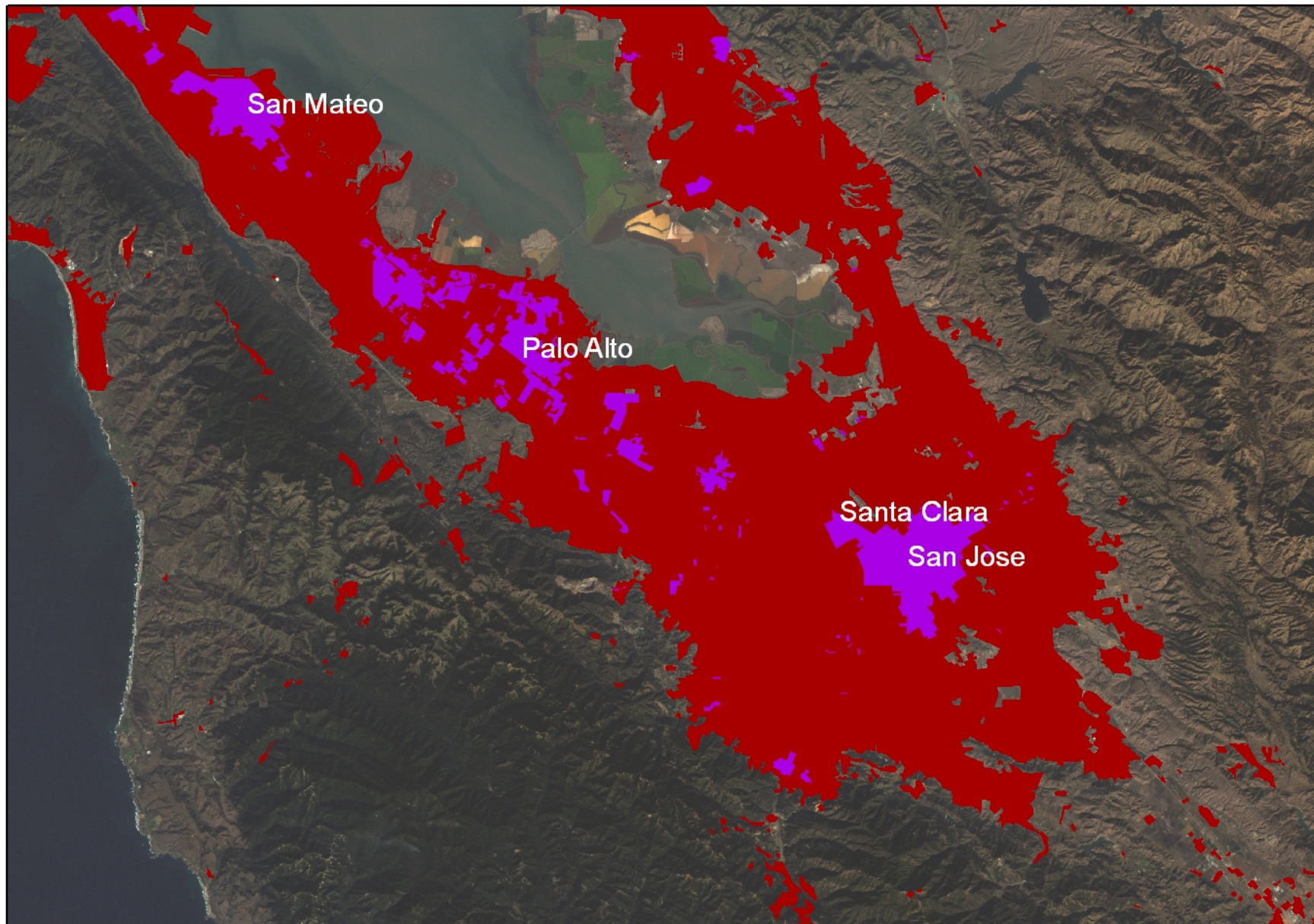
0 5 10 20 Kilometers

Urban Growth in the Silicon Valley: 1984



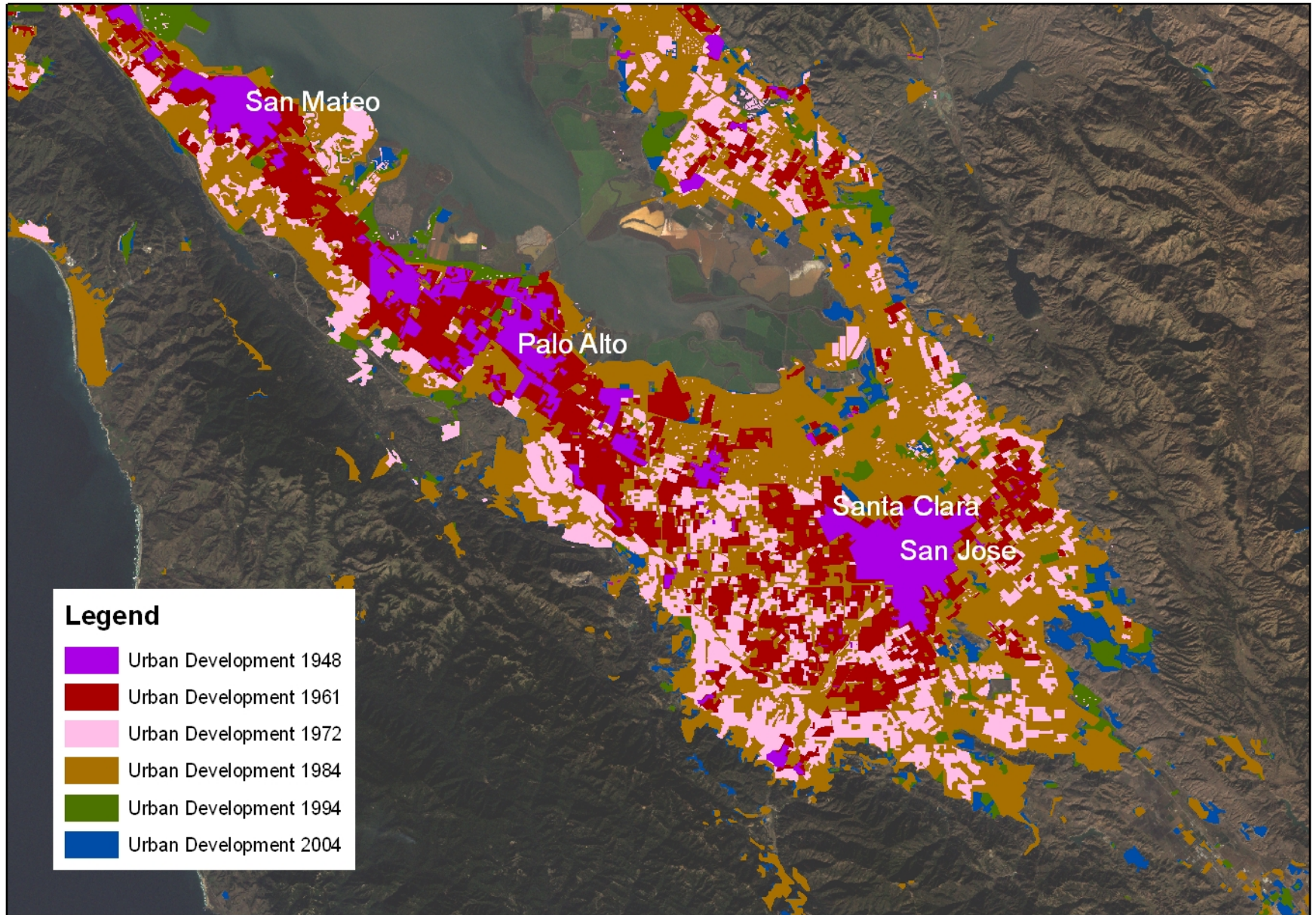
0 5 10 20 Kilometers

Urban Growth in the Silicon Valley: 1994



0 5 10 20 Kilometers

Urban Growth in the Silicon Valley: 1948-2004



0 5 10 20 Kilometers

How and where urban areas have and will develop will affect every aspect of life

- Compact or expansive
- Coastal or arid
- Up or out



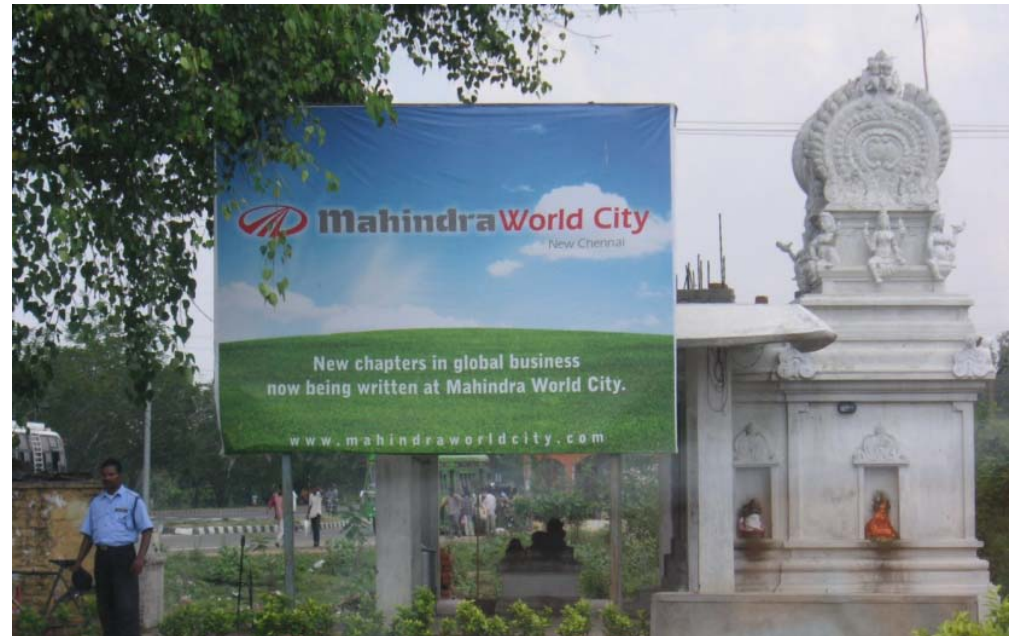
Photo: K. Seto



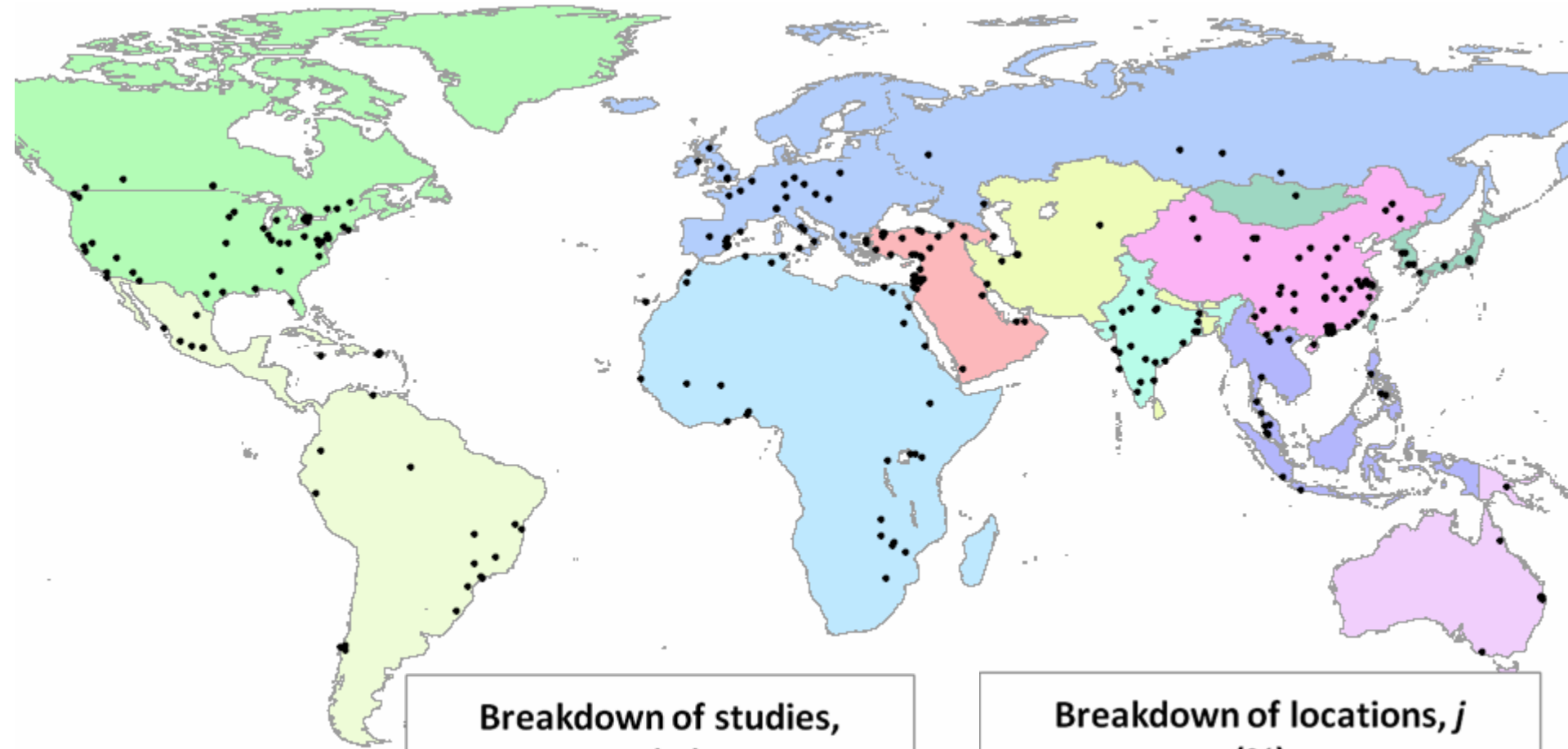
Photo: National Geographic

Current understanding of urban land-use change

- Limited to case studies
- Limited understanding of global trends, patterns, locations, and rates of change

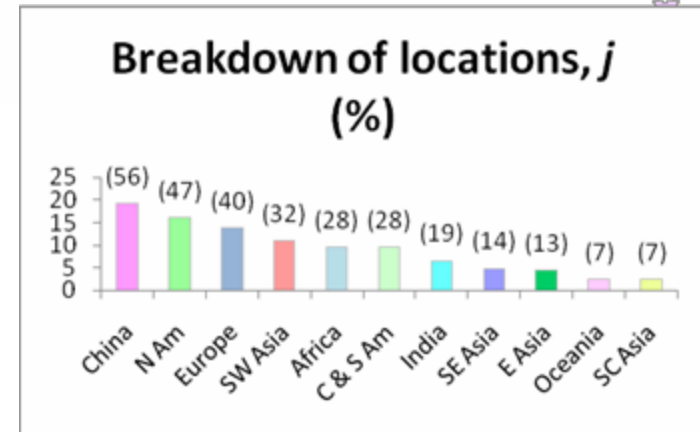
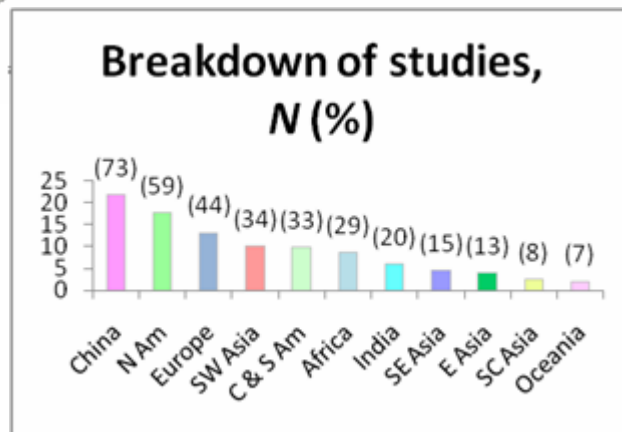


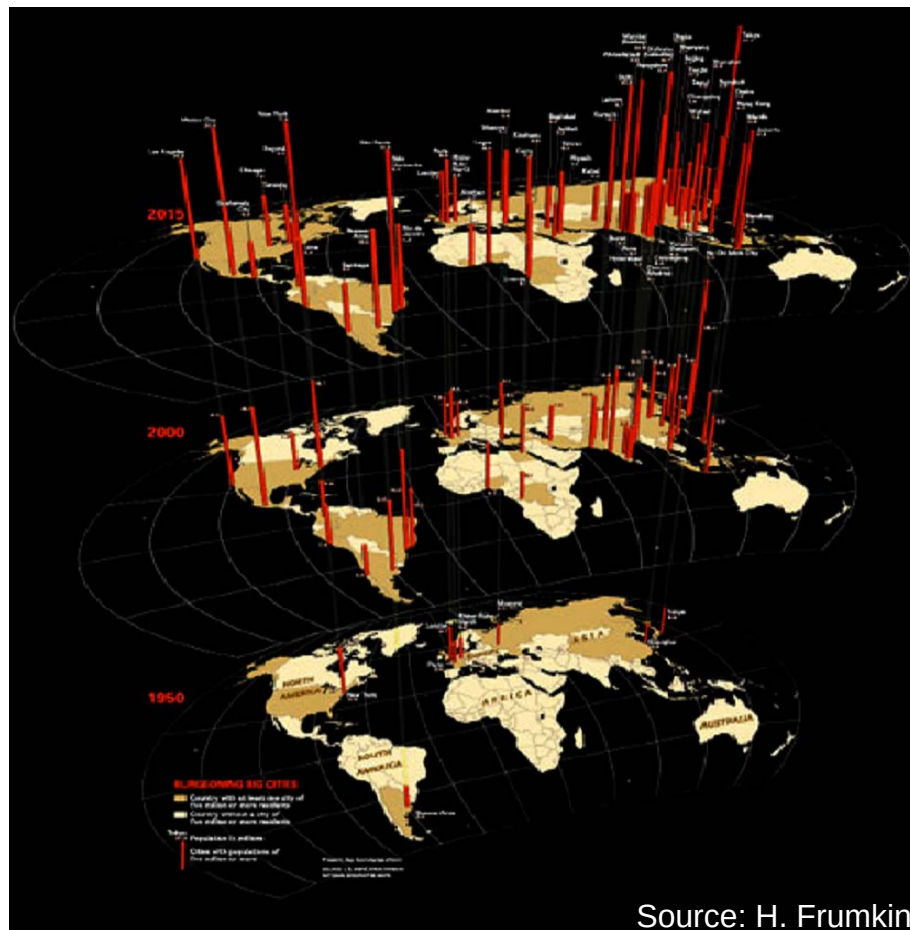
Meta-Study of Global Patterns of Urban Land-Use Change



Total N = 335

Total j = 291



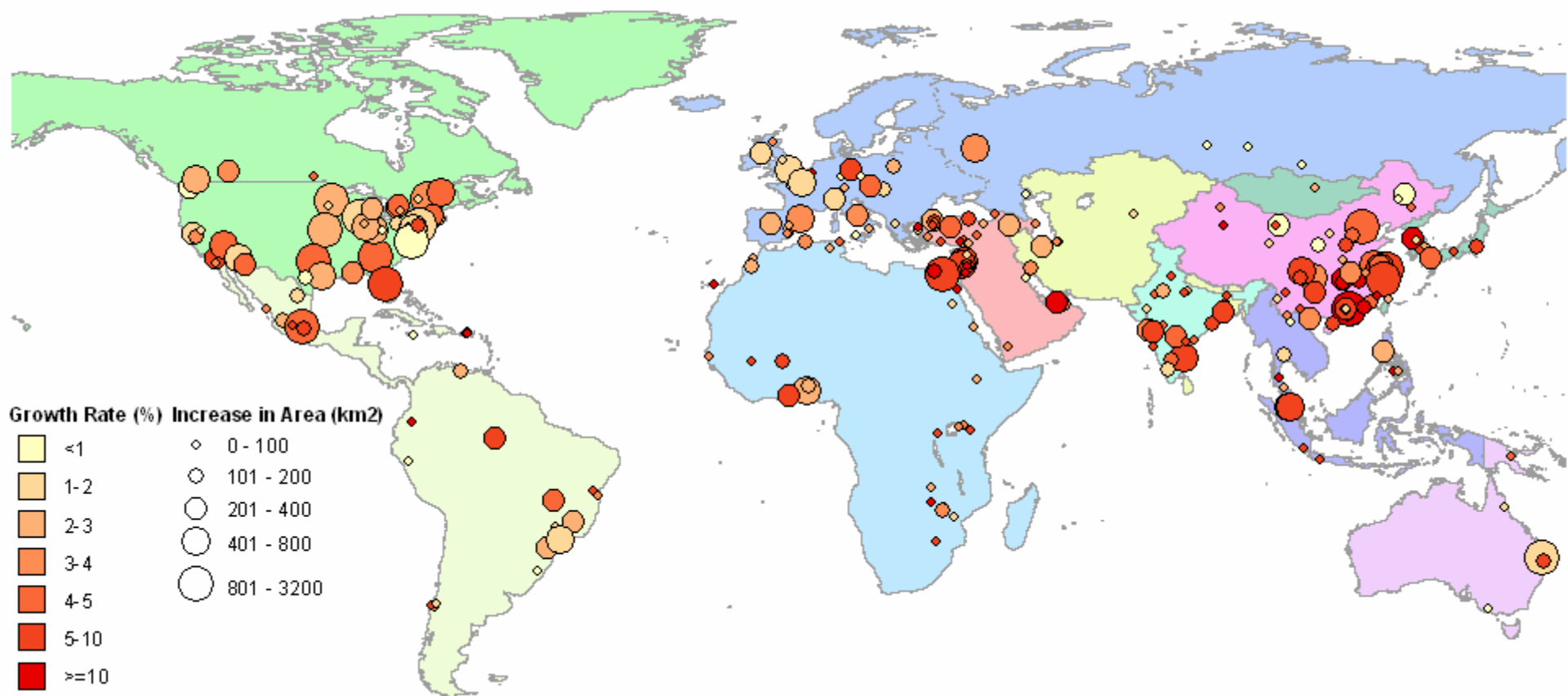


1980	1990	2000	2010
1 21.9 Tokyo	25.1 Tokyo	26.4 Tokyo	26.4 Tokyo
2 15.6 New York	16.1 New York	18.1 Mexico City	23.6 Mumbai
3 13.9 Mexico City	15.1 Mexico City	18.1 Mumbai	20.2 Lagos
4 12.5 São Paulo	15.1 São Paulo	17.8 São Paulo	19.7 São Paulo
5 11.7 Shanghai	13.3 Shanghai	16.6 New York	18.7 Mexico City
6 10.0 Osaka	12.2 Mumbai	13.4 Lagos	18.4 Dhaka
7 9.9 Buenos Aires	11.5 Los Angeles	13.1 Los Angeles	17.2 New York
8 9.5 Los Angeles	11.2 Buenos Aires	12.9 Kolkata	16.6 Karachi
9 9.0 Kolkata	11.0 Osaka	12.9 Shanghai	15.6 Kolkata
10 9.0 Beijing	10.9 Kolkata	12.6 Buenos Aires	15.3 Jakarta
11 8.9 Paris	10.8 Beijing	12.3 Dhaka	15.1 Delhi
12 8.7 Rio de Janeiro	10.5 Seoul	11.8 Karachi	13.9 Los Angeles
13 8.3 Seoul	9.7 Rio de Janeiro	11.7 Dehli	13.9 Metro Manila
14 8.1 Moscow	9.3 Paris	11.0 Jakarta	13.7 Buenos Aires
15 8.1 Mumbai	9.0 Moscow	11.0 Osaka	13.7 Shanghai
16 7.7 London	8.8 Tianjin	10.9 Metro Manila	12.7 Cairo
17 7.3 Tianjin	8.6 Cairo	10.8 Beijing	11.8 Istanbul
18 6.9 Cairo	8.2 Delhi	10.6 Rio de Janeiro	11.5 Beijing
19 6.8 Chicago	8.0 Metro Manila	10.6 Cairo	11.5 Rio de Janeiro
20 6.3 Essen	7.9 Karachi	9.9 Seoul	11.0 Osaka
21 6.0 Jakarta	7.7 Lagos	9.6 Paris	10.0 Tianjin
22 6.0 Metro Manila	7.7 London	9.5 Istanbul	9.9 Seoul
23 5.6 Dehli	7.7 Jakarta	9.3 Moscow	9.7 Paris
24 5.3 Milan	6.8 Chicago	9.2 Tianjin	9.4 Hyderabad
25 5.1 Teheran	6.6 Dhaka	7.6 London	9.4 Moscow
26 5.0 Karachi	6.5 Istanbul	7.4 Lima	9.0 Bangkok
27 4.7 Bangkok	6.4 Tehran	7.3 Bangkok	8.8 Lima
28 4.6 Saint Petersburg	6.4 Essen	7.2 Teheran	8.6 Lahore
29 4.6 Hong Kong	5.9 Bangkok	7.0 Chicago	8.2 Chennai
30 4.4 Lima	5.8 Lima	6.9 Hong Kong	8.1 Teheran

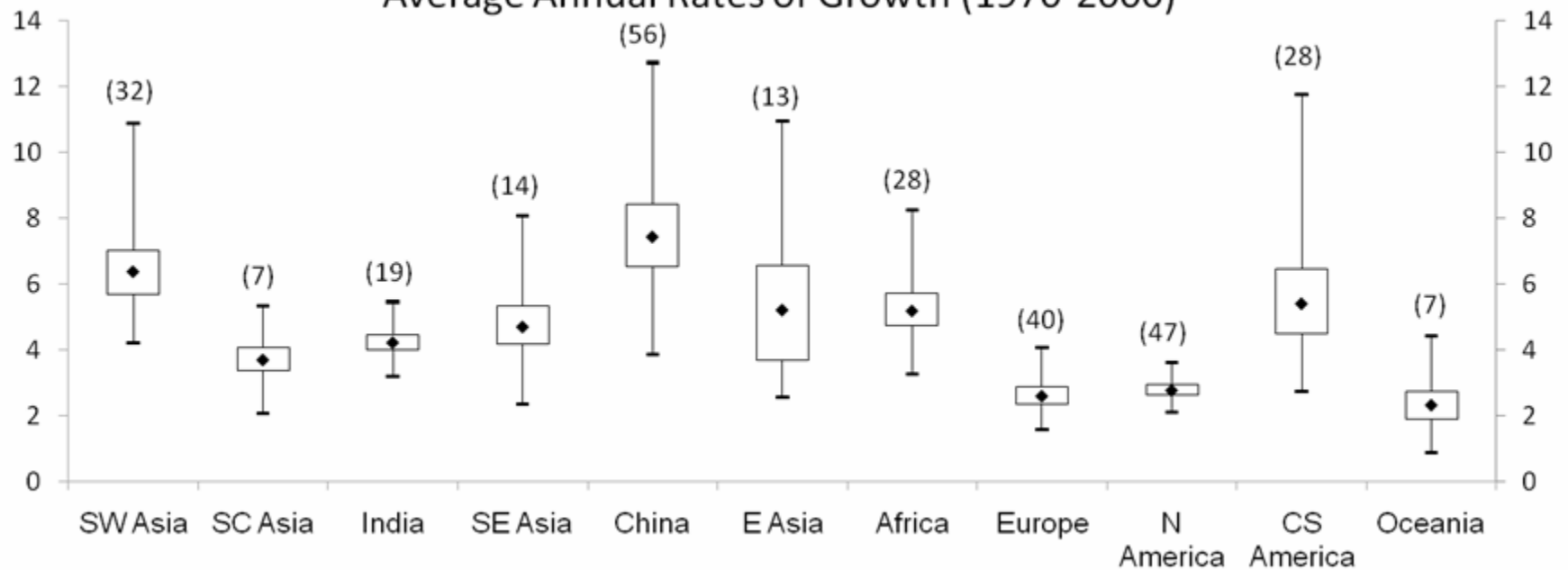
Adapted from UN Center for Human Settlements

Key Point: We do not monitor spatially many important urban agglomerations that have moved up rapidly in the ranks of world's largest cities

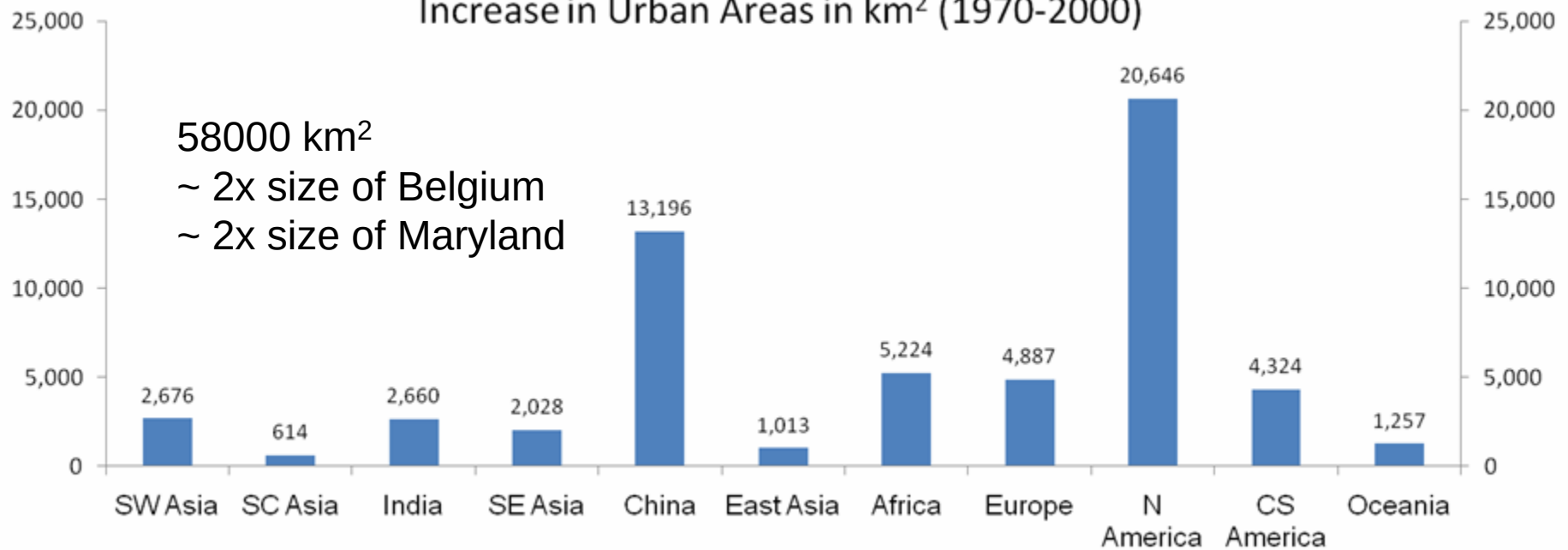
Magnitudes and Rates of Urban Growth, 1970-2000



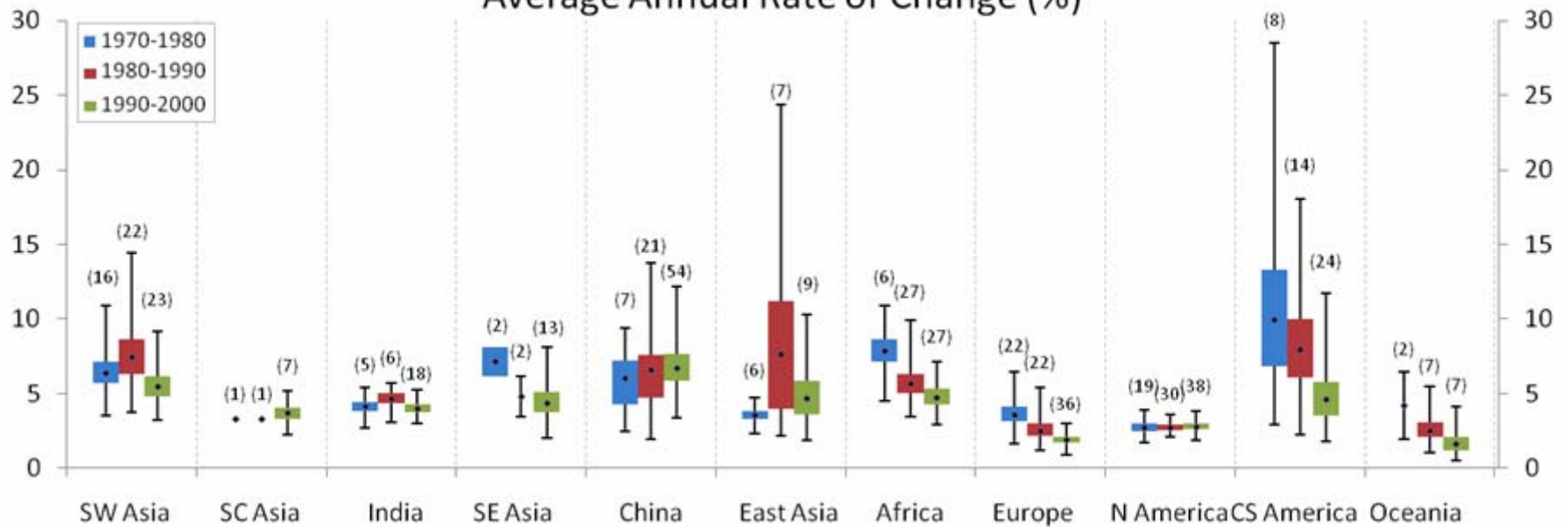
Average Annual Rates of Growth (1970-2000)



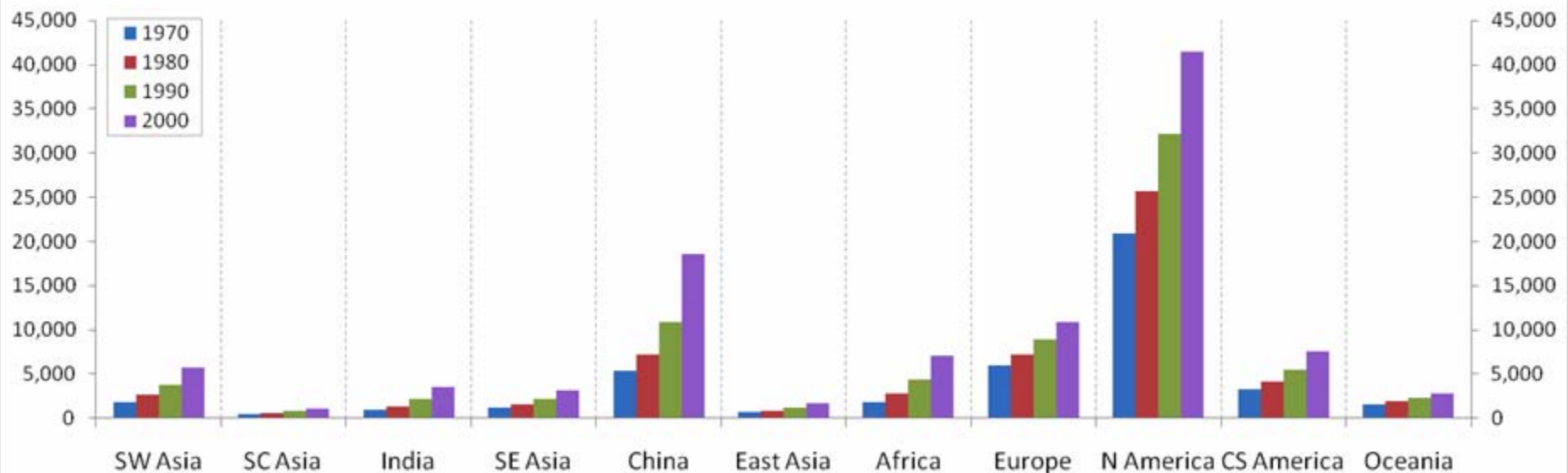
Increase in Urban Areas in km² (1970-2000)



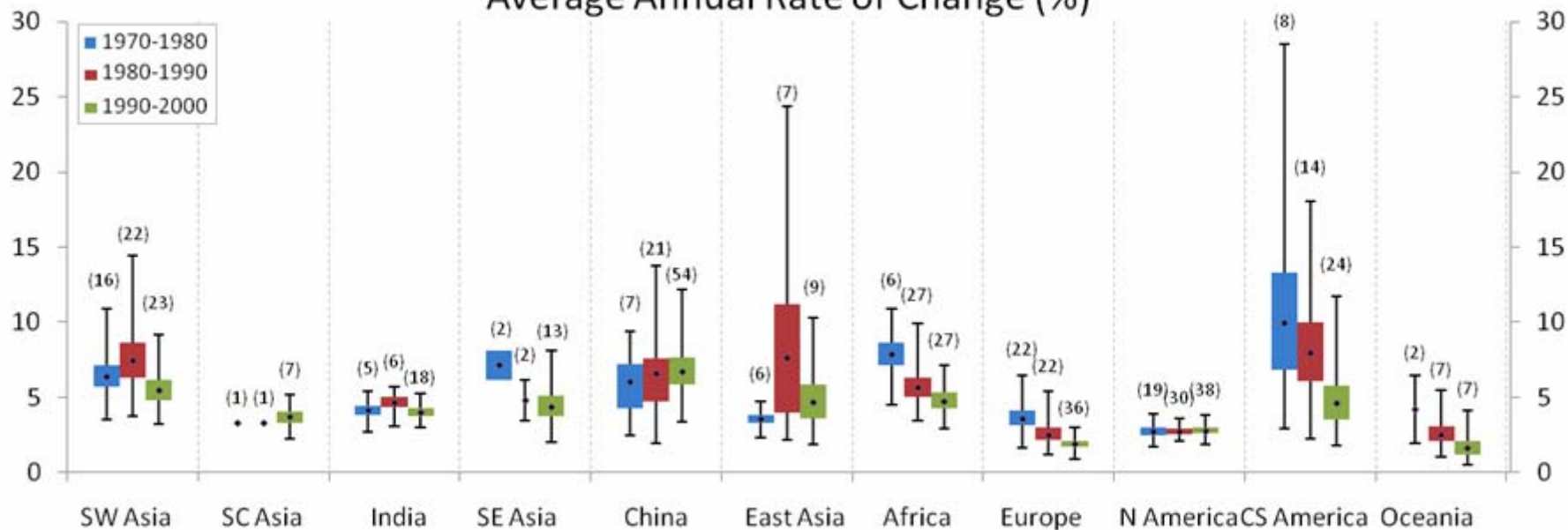
Average Annual Rate of Change (%)



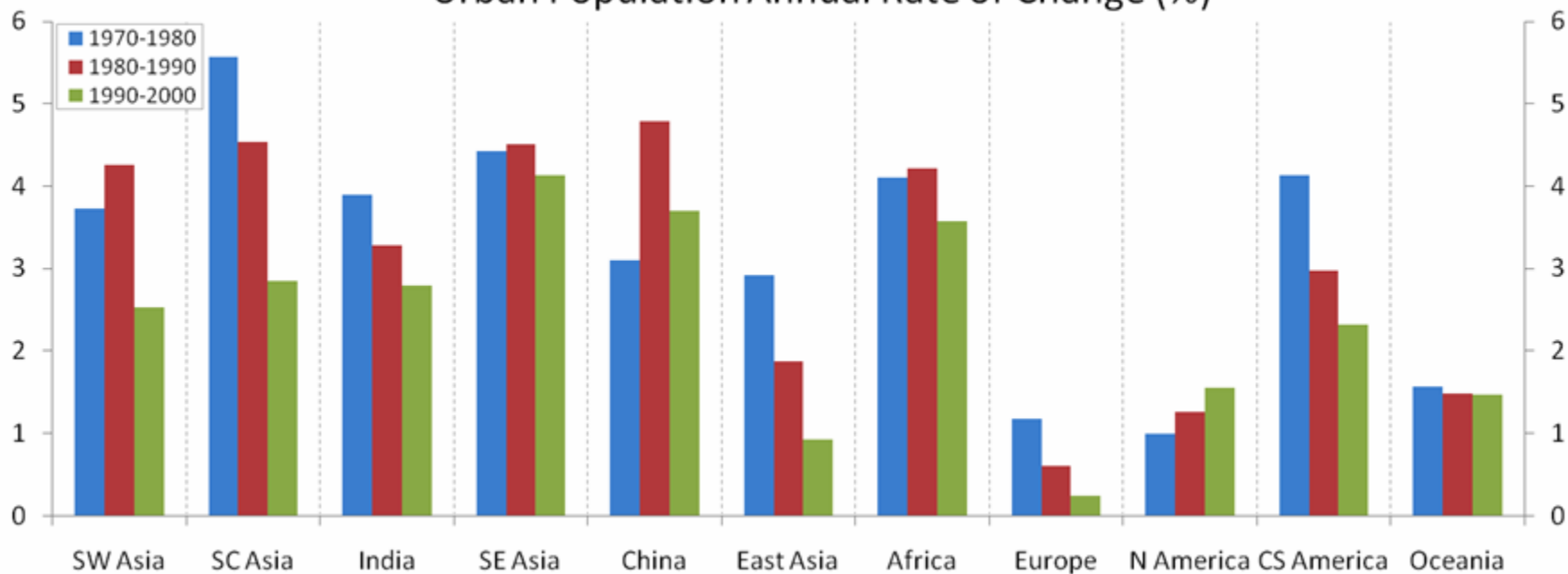
Urban Areas at Start of Decade (km²)



Average Annual Rate of Change (%)



Urban Population Annual Rate of Change (%)



Implications of Urban Land-Use Change Patterns and Rates

- Effectiveness of policies
- Land conservation efforts
- Energy consumption and GHG emissions
- Adaptation and mitigation to climate change
- Agricultural land
- Local and global climate



Final Points

- Despite more than 30 years of satellite observations, our understanding of global patterns of urban land-use change is fragmented, with most studies focusing on large urban areas and fewer studies of medium and small cities.
- In many rapidly regions, urban land-use change is faster than urban population change
- Urban land-use patterns will affect response to climate change