Uncovering City Dynamics through Land Use and Land Cover Spatial Data

(Stuff you can tell about cities just by staring at land use maps)

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Land and Poverty Conference 2017
March 23, 2017

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Acknowledgements

» The core team responsible for the spatial work under the *Karachi Transformation Strategy* was led by Jon Kher Kaw (Senior Urban Specialist) and Peter D. Ellis (Lead Urban Economist), and include team members: Mark Roberts (Senior Urban Economist), Sohaib Athar (Urban Economist), Jane Park (Consultant), Sangmoo Kim (Urban Specialist), Jessica Schmidt (Urban Specialist) and Ming Zhang (Practice Manager).

» The team responsible for the work on *Urban Planning Effectiveness in Kandy* was led by Jon Kher Kaw (Senior Urban Specialist), Mark Roberts (Senior Urban Economist), Katie McWilliams (GIS Specialist) and Sangmoo Kim (Urban Specialist).

» The team was supported by Tomas Soukup, GiSAT and Naijin Zhou, University of Maryland who were responsible for generating land use cover data for Karachi and Kandy respectively.

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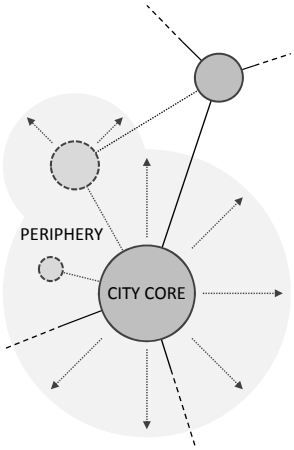
Understanding how cities are physically planned and shaped critical to productivity and livability



Source: The World Bank Group

INTER-CITY CONNECTIVITY
- » Forming of well-connected and efficient system of cities

PERIPHERY GROWTH
- » Intra-city connectivity
- » Planning ahead & facilitate new centers

CITY CORE / LAND USE
- » Assets, available land resources
- » Density vs. public spaces
- » Congestion

INSTITUTIONS
- » Planning
- » Urban governance & capacity

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Challenges and opportunities of spatial land use mapping in a data-scarce environment

Challenges in understanding how cities are organized internally
- » Lack of or outdated granular city-level spatial data
- » Existing land use data not available
- » Master plans do not correspond to ground conditions
- » Need for timely and rapid assessment in World Bank projects

Opportunities in the use of satellite land use maps to tease out
- » 2D spatial organization
- » 3D density and city form
- » 4D changes over time

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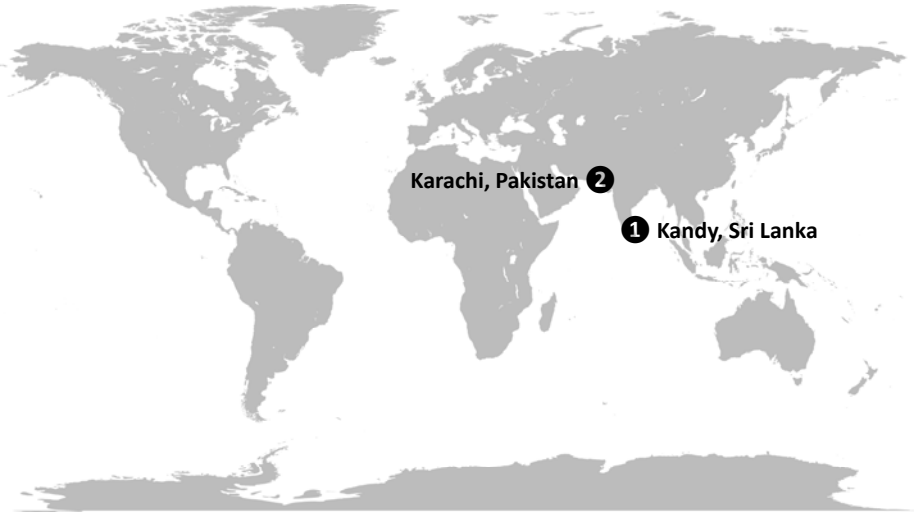
A rapid observation of two cities through the lens of land use maps



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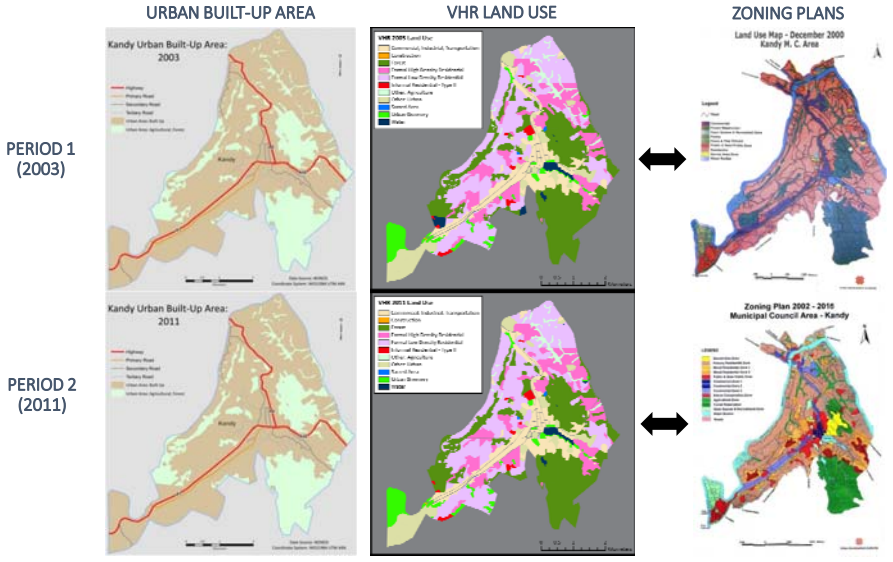
1 Do land use cover match zoning plans?



Source: World Bank | Source: World Bank | Source: Urban Development Authority

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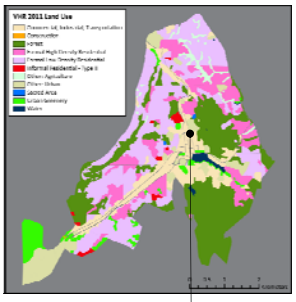
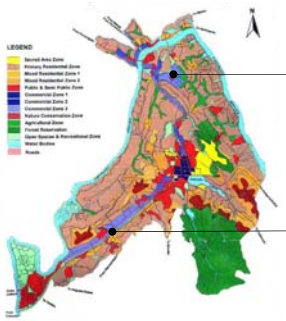
❷ Structural differences between actual and planned

VHR LAND USE (2011)



Source: Urban Development Authority

ZONING PLAN (2002 – 2016)



Source: Urban Development Authority

Commercial cluster not seen in VHR land use → polycentric structure?

Ribbon development in master plans → planned or resultant?

Inconsistent land uses → Commercial (large hotels, schools) on primary residential zones

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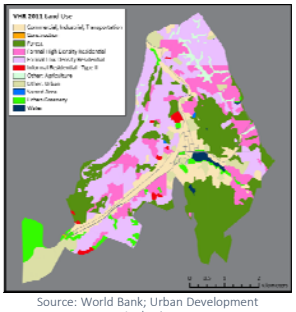
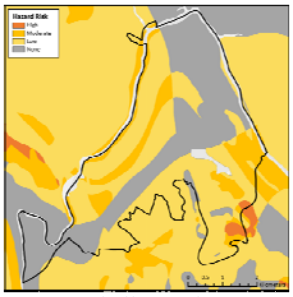
❸ Constraints of land use by disaster risks and terrain

VHR Land Use (2013)



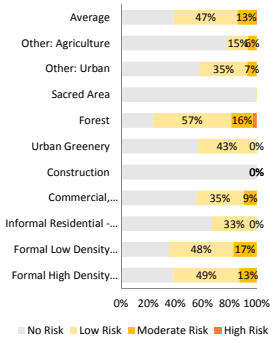
Source: World Bank; Urban Development Authority

Hazard Risk Zones



Source: National Building Research Organization

Hazard Risk Zones by VHR Land Use (%)



- >60% of residential land are affected by landslides to some degree
- 13%-17% of residential land with higher landslide risks
- 9% of commercial land face with higher landslide risks

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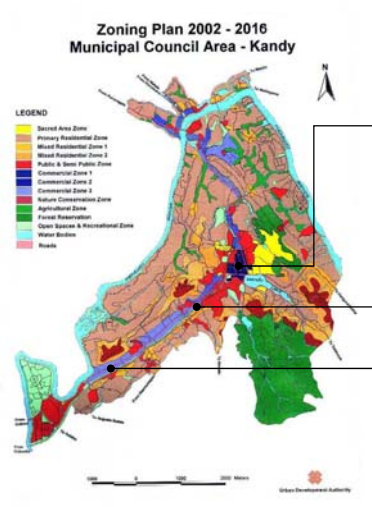
❹ Do regulations encourage ribbon-type developments rather than compactness?



COMMERCIAL ZONE I
- Include "Primary Residential Zone"
- Retail and Commercial
- Building heights <= 12m

COMMERCIAL ZONE II
- Retail and Commercial
- Car parks, garages, service stations, printing presses
- Houses and flats

COMMERCIAL ZONE III
- Includes "Commercial Zone I and II"
- Hotels, Medical and Education
- Light industrial

CITY CORE
More restrictive land use and urban design

ALONG ROADS
More flexible land use

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❺ Planning guidelines to conserve heritage buildings could be a reason for ribbon developments…

LOCATIONS OF CONSERVED BUILDINGS WITHIN GRID CITY

BUILDINGS DESIGNATED AS UNESCO WORLD HERITAGE CITY LANDMARKS

- Commercial zoning
- Height restriction of <12 meters
- Buildings with conservation requirements
- Disperse all over Grid City (CBD)

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That could have missed opportunities for innovative policies to encourage adaptive reuse?





- Underutilized or vacant
- Dilapidated heritage buildings

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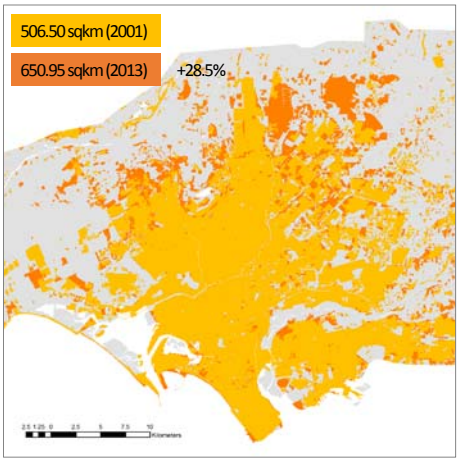
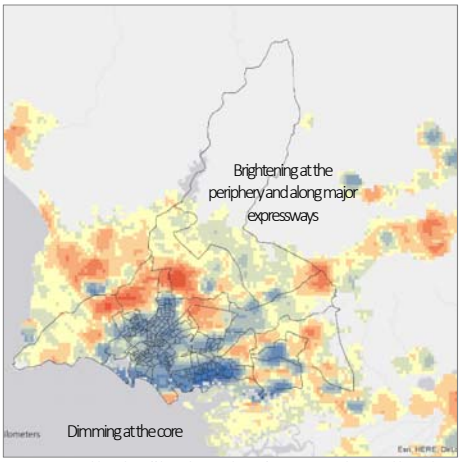
6 Urban footprint expansion, accompanied by decline in economic vibrancy in city core

URBAN FOOTPRINT (2001 – 2013)



Source: World Bank staff based on analysis of ESA land use maps

CHANGE IN NIGHT TIME LIGHTS INTENSITY (1999 – 2010)



Source: World Bank staff based on analysis of DMSP-OLS radiance-calibrated nighttime lights data

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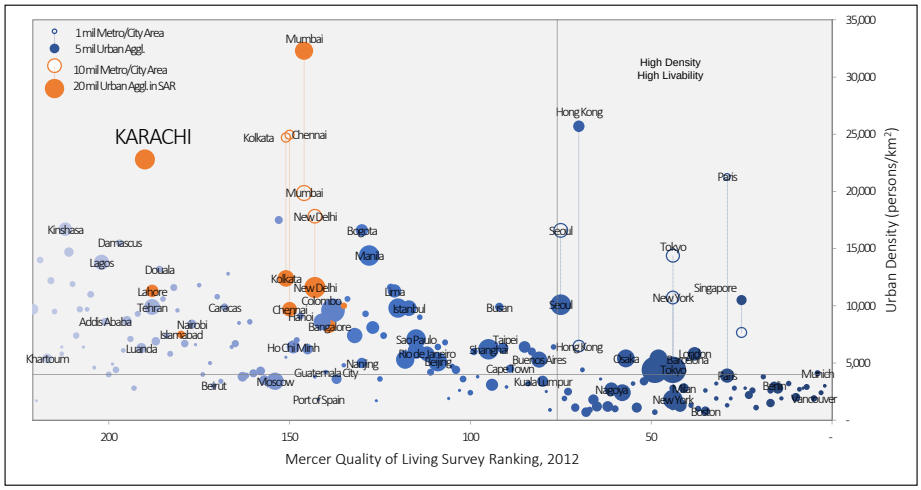
❼ Karachi is emerging as a densely populated city with very low quality of living…

GLOBAL URBAN POPULATION DENSITY AND QUALITY OF LIVING, 2012



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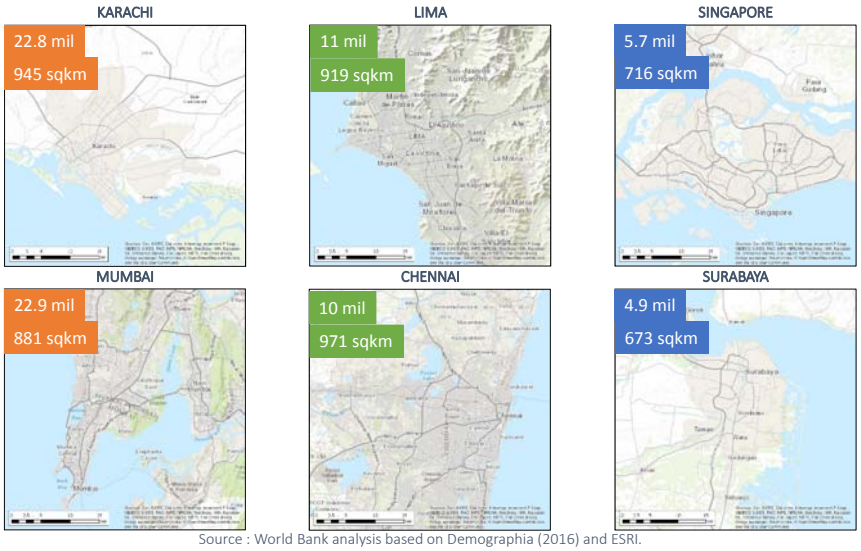
Especially when compared to many other waterfront cities of similar urban footprints



Source : World Bank analysis based on Demographia (2016) and ESRI.

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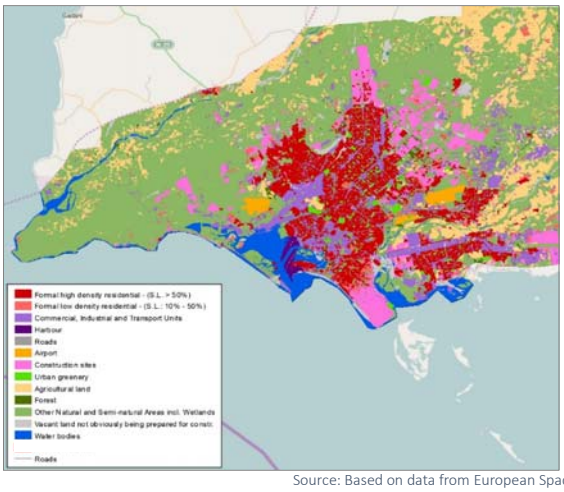
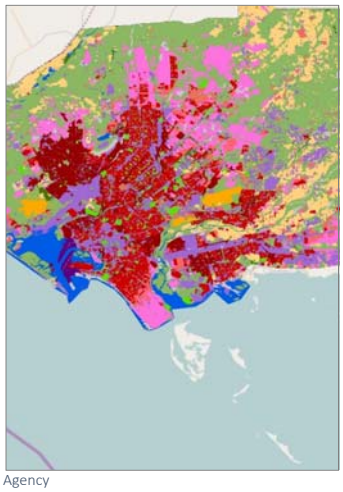
8 Land use patterns show need for better city and land resource management at the city core and periphery

LAND USE PATTERNS (2001)



LAND USE PATTERNS (2013)



Source: Based on data from European Space Agency

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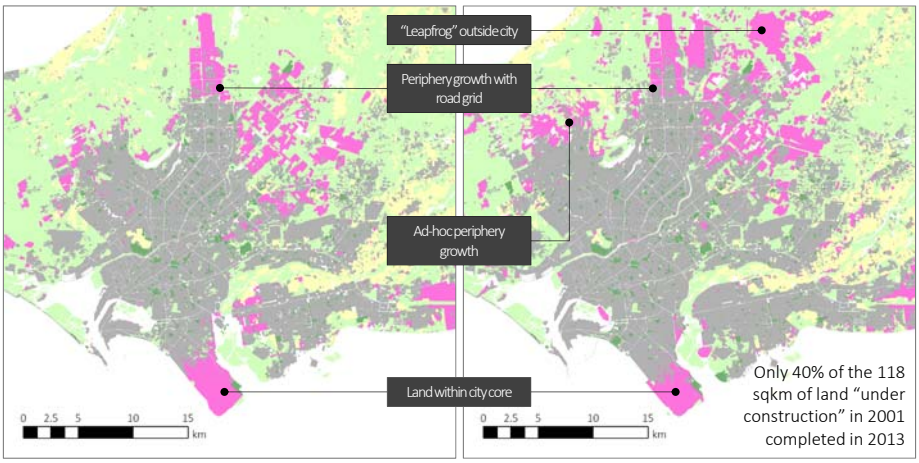
9 Land use patterns changes can show poor coordination amongst development institutions…

LAND "UNDER CONSTRUCTION" (2001)

LAND "UNDER CONSTRUCTION" (2013)



Source: Based on data from Government of Sindh Urban Unit & European Space Agency

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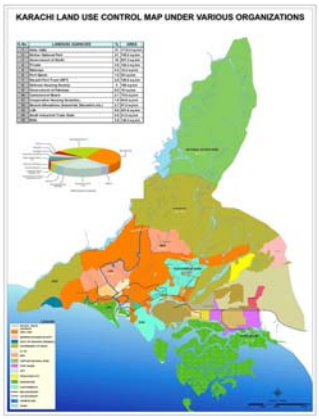
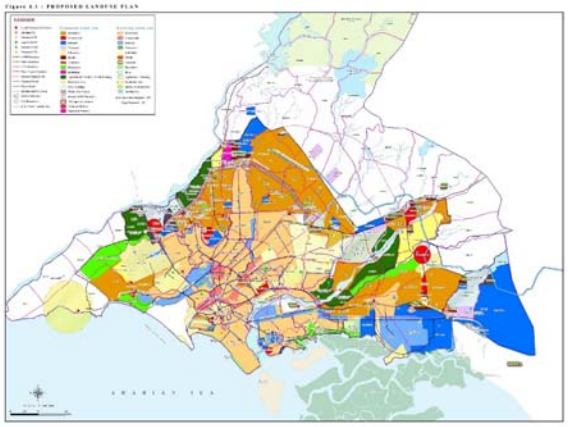
And illustrates how fragmented land ownership with different development timeframes, plans and service delivery standards can affect city growth

LAND CONTROL



Source: Government of Sindh

KARACHI STRATEGIC DEVELOPMENT PLAN 2020



Source: Government of Sindh

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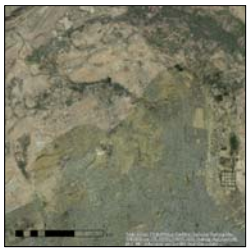
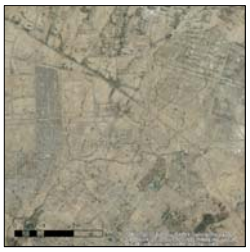
❿ Types of inefficient land use patterns

NORTHWEST PERIPHERY



CITY CORE

NORTHEAST PERIPHERY



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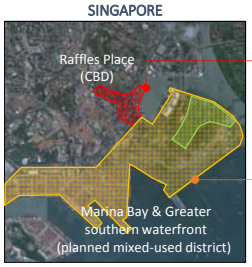
⓫ Scale of underutilized land

KARACHI

NEW YORK

LONDON

SINGAPORE



~1.1 mil sqm prime office space

~480 hectares of land
~5.5 mil sqm office space
~2 mil sqm retail space
~7,000 residential units
~60 hectares of park space
+ other amenties

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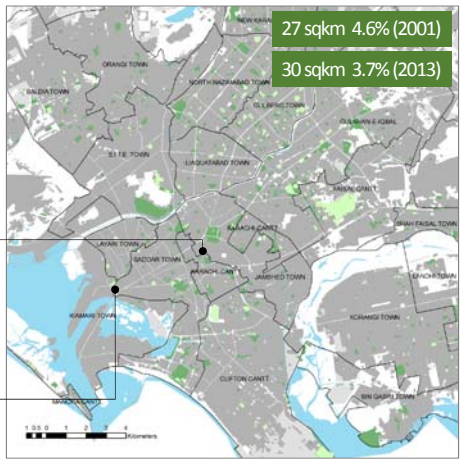
⓬ Underleveraged heritage assets & waterfronts, declining urban green and public spaces

NATURAL AND HERITAGE ASSETS WITHIN CITY CORE

URBAN GREEN SPACES



Source: Based on data from Government of Sindh Urban Unit & European Space Agency

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Land use maps were useful to illustrate pressures on city growth

- Spatial
  - Inefficient land use patterns
  - Density and (lack of) open spaces
  - Structure of city – monocentric, polycentric
- Planning and regulation
  - Tension between regulation to preserve the heritage assets in city core and city expansion/sprawl
  - Mismatch between planned city structure and ground realities
- Institutions
  - Poor coordination with fragmented institutions
- Disaster risks
  - Quantify and identify disaster risk areas
  - Suitability of land due to terrain
- Scale of untapped potential
  - Locked land
  - Underutilized land

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Thank you!

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