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

**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- Lack of or outdated granular city-level spatial data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

Source: The World Bank Group
A rapid observation of two cities through the lens of land use maps

1. Do land use cover match zoning plans?
2. Structural differences between actual and planned

VHR LAND USE (2011)  
ZONING PLAN (2002 – 2016)

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

Source: Urban Development Authority

3. Constraints of land use by disaster risks and terrain

VHR Land Use (2013)  
Hazard Risk Zones

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

Source: World Bank; Urban Development Authority
Source: National Building Research Organisation

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**4** 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

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**5** 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)
That could have missed opportunities for innovative policies to encourage adaptive reuse?

- Underutilized or vacant
- Dilapidated heritage buildings

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

![Urban Footprint Map](image)

**URBAN FOOTPRINT (2001 – 2013)**

506.50 sqkm (2001)

650.95 sqkm (2013)

+28.5%

**CHANGE IN NIGHT TIME LIGHTS INTENSITY (1999 – 2010)**

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

Source: World Bank staff based on analysis of SNAP-GUS radiance-calibrated nighttime lights data
Karachi is emerging as a densely populated city with very low quality of living...

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

Source: World Bank analysis based on Demographia (2016) and ESRI.
Land use patterns show need for better city and land resource management at the city core and periphery.

Land use patterns changes can show poor coordination amongst development institutions...
And illustrates how fragmented land ownership with different development timeframes, plans and service delivery standards can affect city growth.

**Types of inefficient land use patterns**
11 Scale of underutilized land

- **Karachi, New York, London, Singapore**

- **Midtown Manhattan (CBD)**
  - ~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 amenities
  - ~1.1 mil sqm prime office space

- **Marina Bay & Greater Southern Waterfront (planned mixed-use district)**

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

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

Thank you!

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