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LCLUC
Land-Cover / Land-Use Change Program

Green and Blue Infrastructure in a Changing Urban Environment

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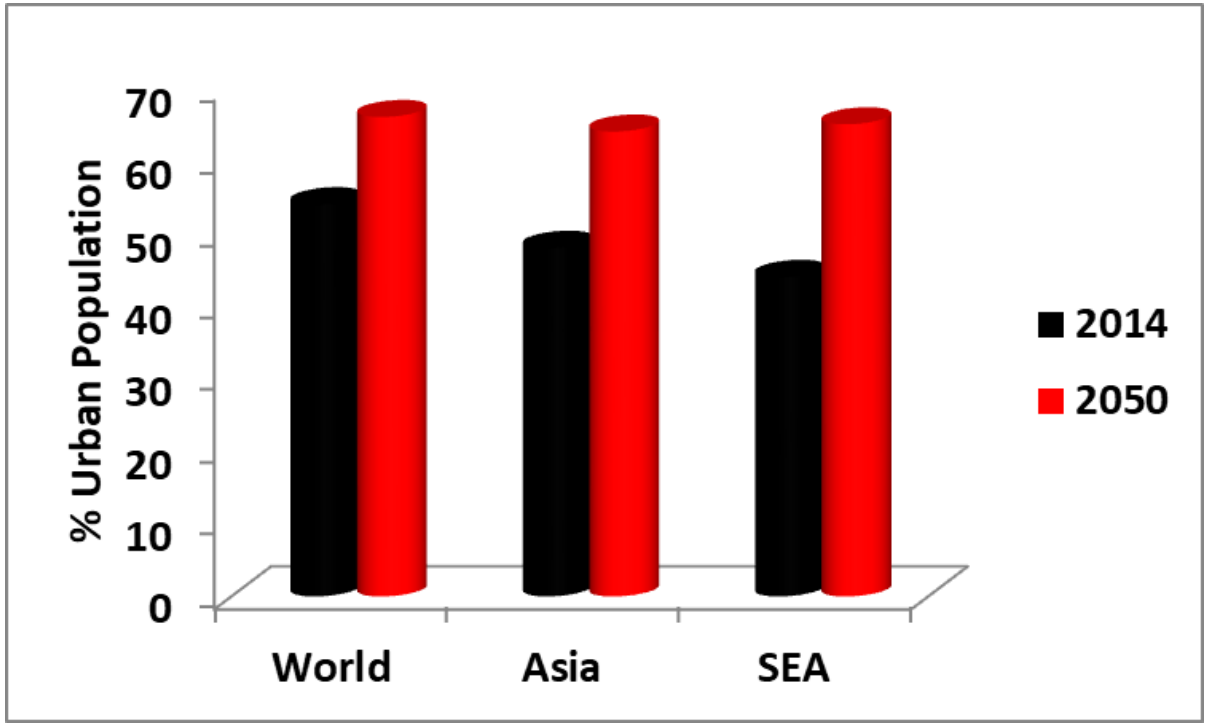
Land Cover/Land Use Changes (LC/LUC) and Impacts on Environment in South/Southeast Asia
28-30th May, 2018

Urban development and impacts on environment

- People living in urban will increase
- Increase pressure on land
- LULC change will impact the environment, social and economy
- Essential to focus on urban environment and various issues
- One of the pressing environmental issue is loss of green space



Green and Blue Infrastructure

- Surfaces covered by vegetation and water features
- Green infrastructure provides various services and functions
- Importantly improves public health
  - Air quality, urban temperature, noise level
- Sustainable Development Goal 11: Make cities inclusive, safe, resilient and sustainable

  - Target 11.7: Provide universal access to safe, inclusive and accessible, *green and public spaces*
  - Indicator 11.7.1 The average share of the built-up area of cities that is open space for public use


Kepong metropolitan park, KL, Malaysia

Green infrastructure issues

- Destruction of green space and fragmentation
- Maintaining and/or increasing urban green space is essential
- Provision of the benefits of green space is depending on its compositional and structural attributes:
  - Availability (Ha or %)
  - Accessibility (distance between settlements and green spaces)
  - Configuration (species richness, composition)
- Availability is proxy indicator of health and other environmental benefits
- Lack of data and knowledge on existing green space, their types etc. especially in SEA

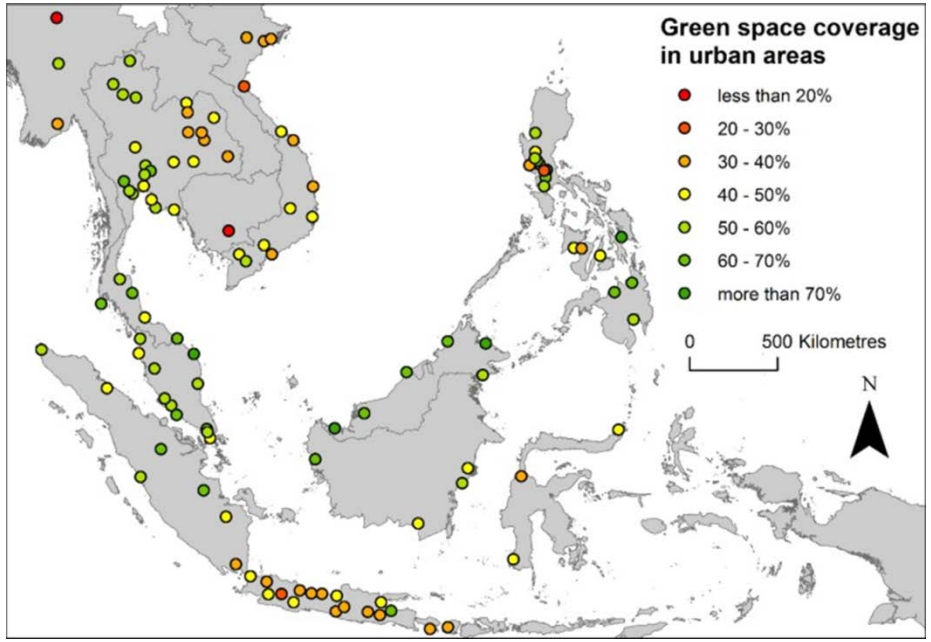
Kanniah, 2017

Current study

- Quantify the availability of different types of green (trees/shrubs and grass) and compute green space per capita
- Green space data is important for assessing current scenario and to set goals to effectively manage resources in cities
- For Kuala Lumpur- it aspires to become top 20 most liveable cities in the world and tropical garden city by 2020

Previous studies and Motivation

Richards et al. (2017)

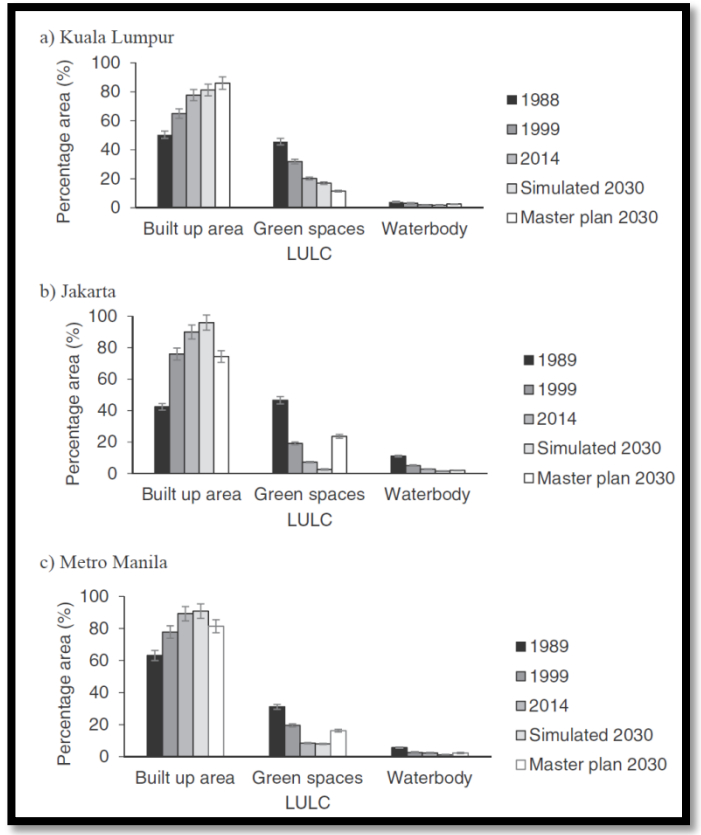


- Green space availability in 111 SEA cities using Landsat images of 2012

Huang et al. (2017)

- Two cities in SEA were included
- Increase in green space (6% in Manila and 1% in Jakarta between 2005 and 2015

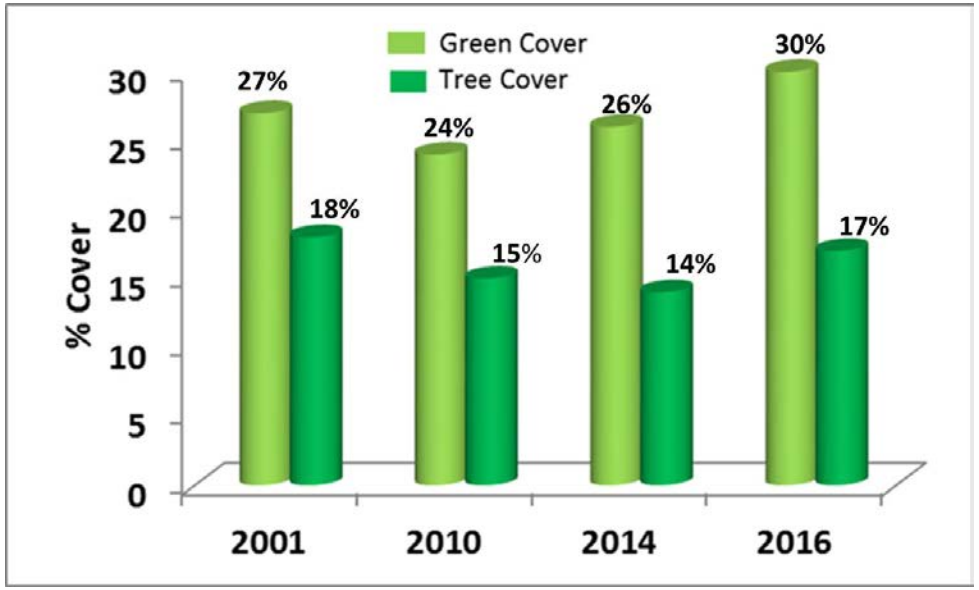
Nor et al.(2017)



- Decreasing trend over time

Motivation

- Kanniah and Ho (2016)- tree cover change in several cities in Malaysia (4-17% tree cover lost between 2000 and 2012)
- Kanniah (2017)- Green space availability and change in Kuala Lumpur (2001-2016) -increase since 2010



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Original article

Quantifying green cover change for sustainable urban planning: A case of Kuala Lumpur, Malaysia

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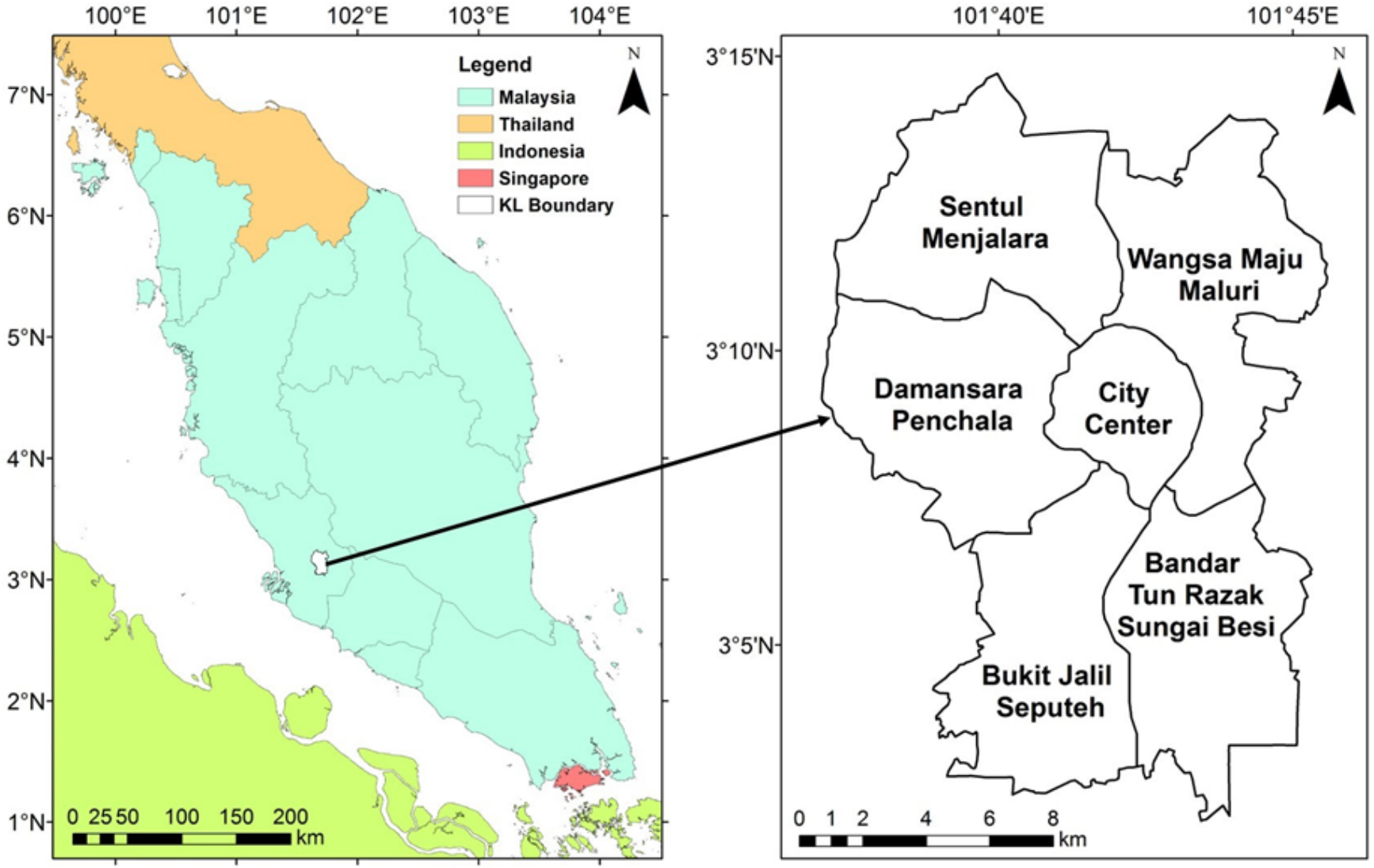
Study Focus: Kuala Lumpur

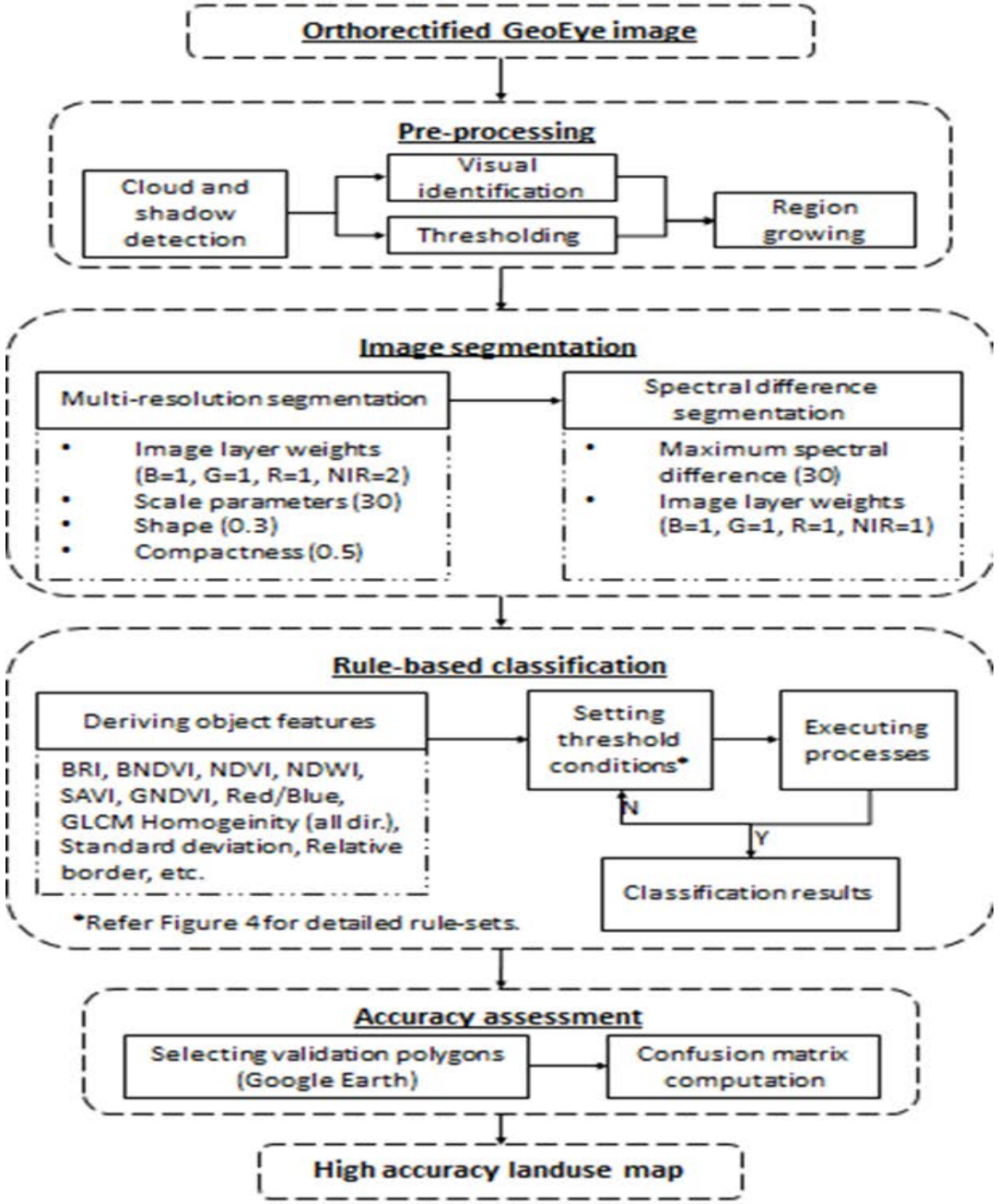


Total land area = 242 km^2

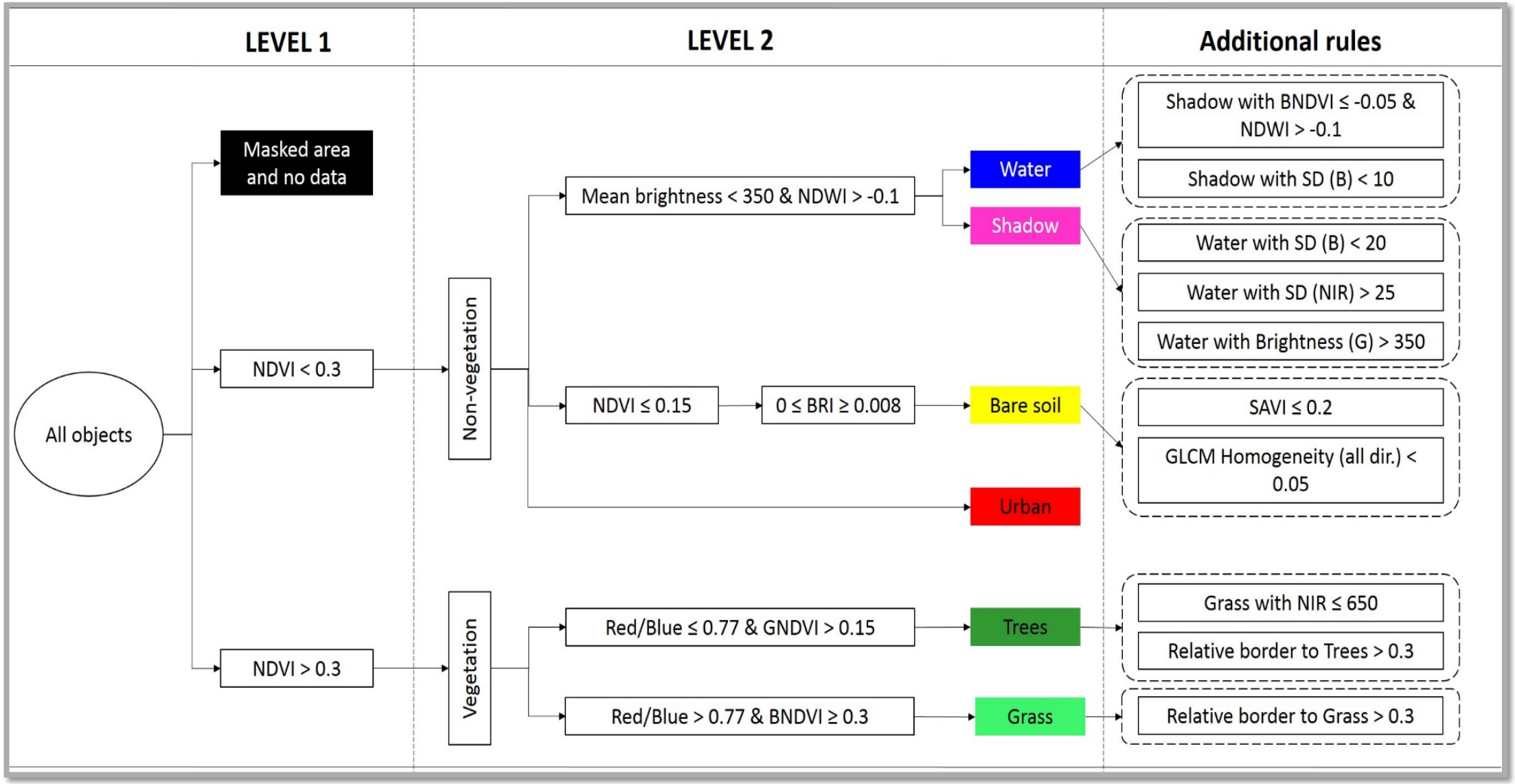
Population in 2016 = 1.73 million

Data

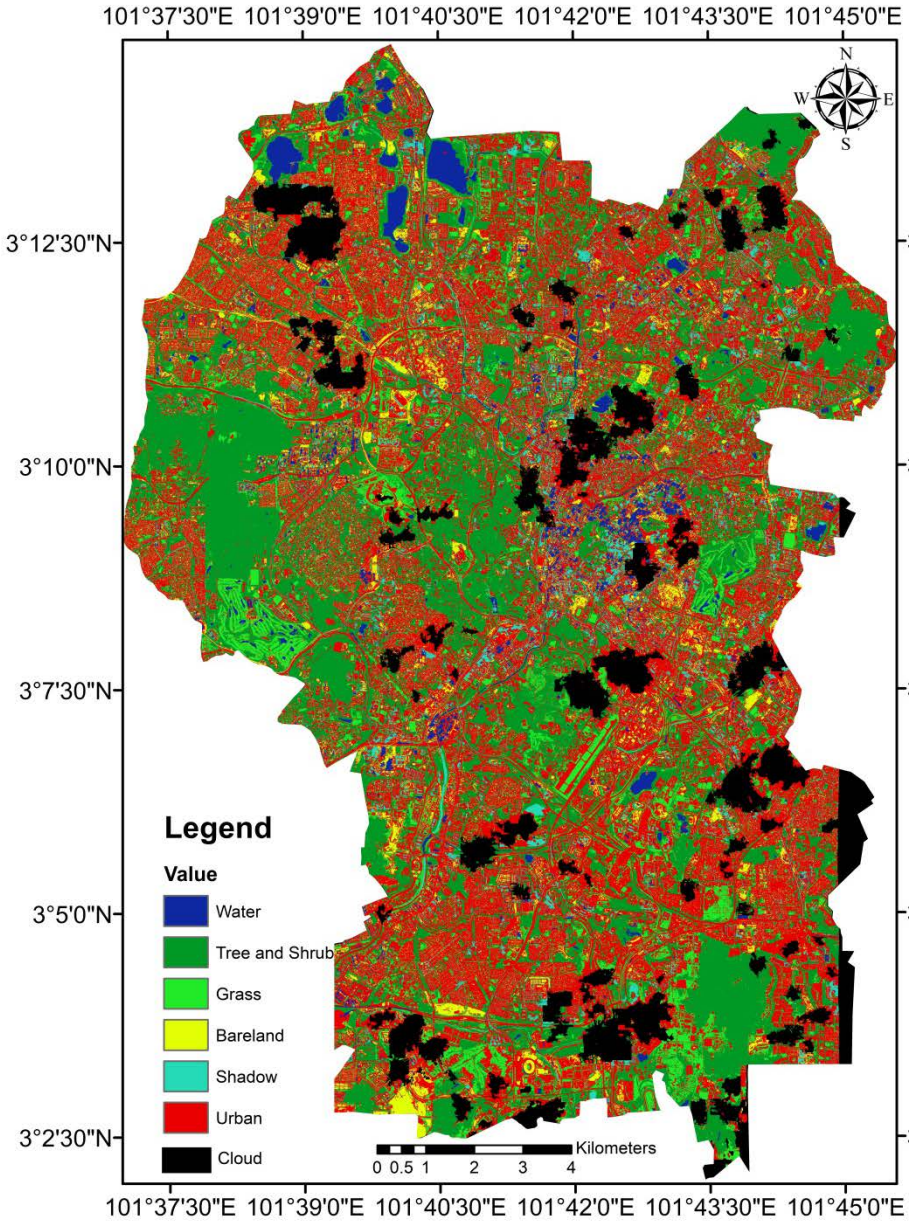
- Geo-eye data 2016
  - Orthorectified image
  - Fine resolution- 0.46 m
  - 4 spectral bands
- Object oriented Classification
- Pre-processing (cloud and shadow detection)
- Image segmentation
- Rule based classification



Hierarchical rules



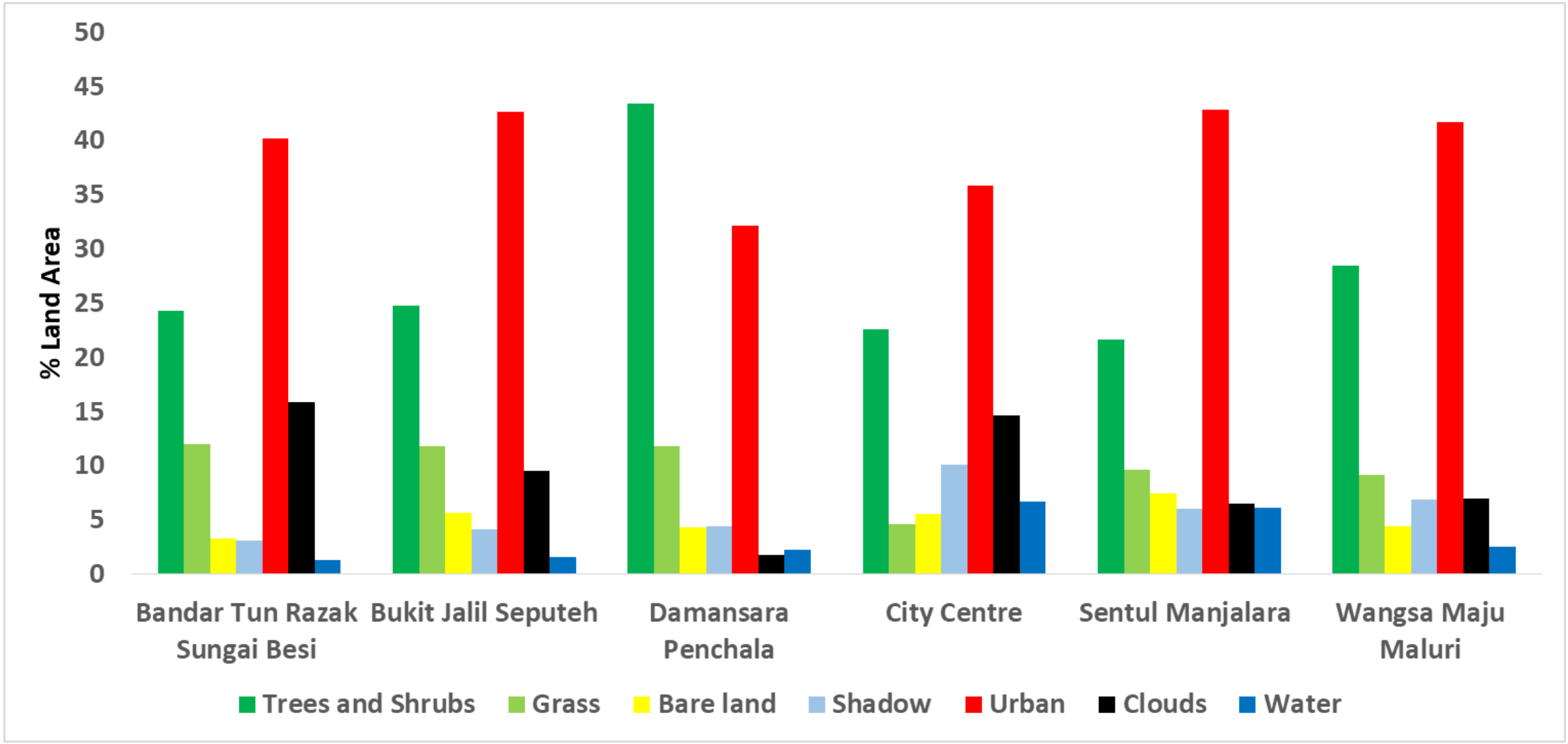
Classification Results



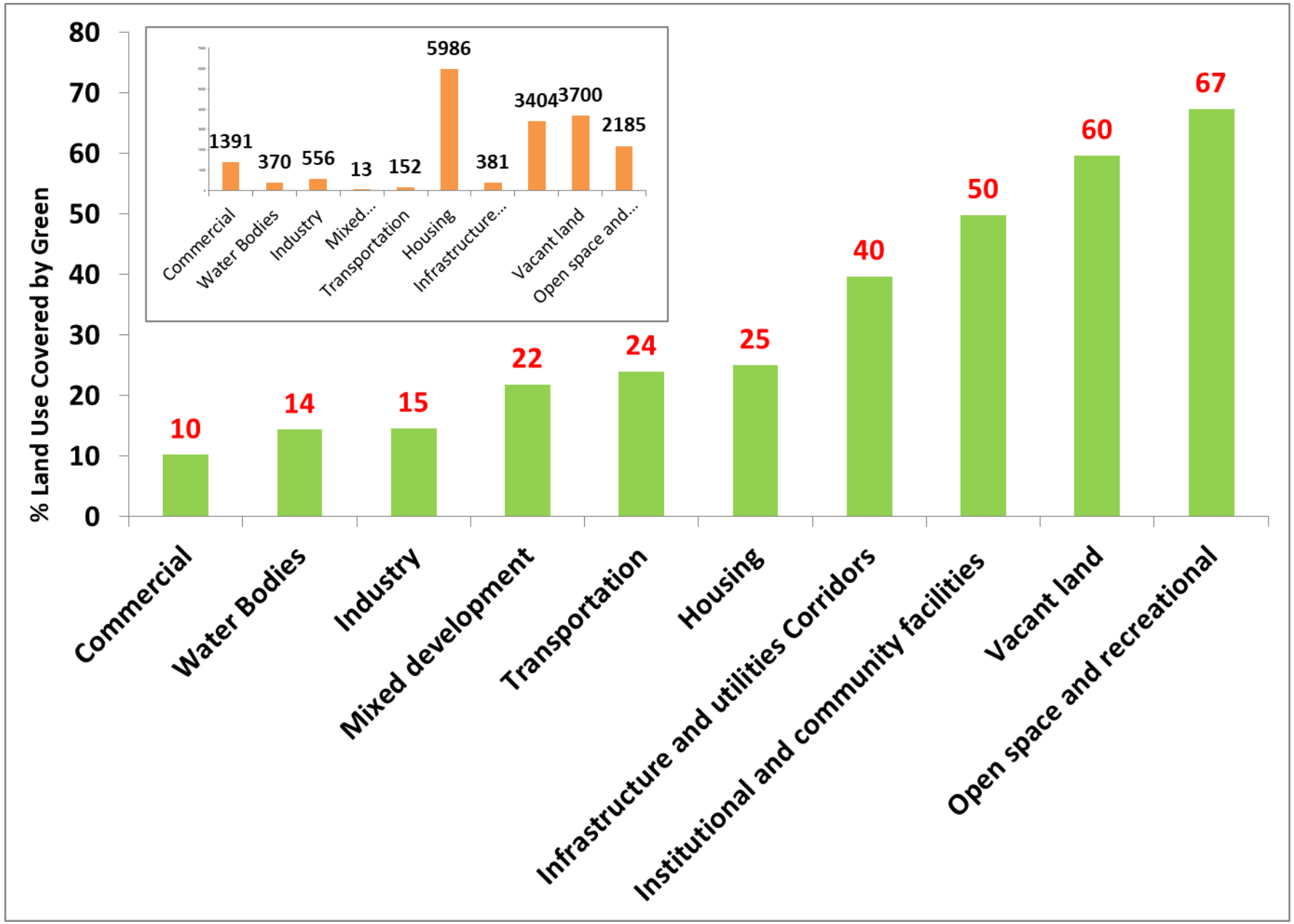
Accuracy Assessment			
	Prod. Acc.	User Acc.	Overall accuracy 93.58% Kappa coefficient of 0.91
Water	89.62	98.32	
Grass	93.08	99.27	
Urban	91.30	94.32	
Tree	99.56	90.54	
Bare land	91.67	79.39	

Land Cover	Trees & Shrubs	Grass	Bare land	Urban	Water	Shadow	Cloud
Area (Ha)	6807	2509	1226	9598	744	1287	2068
%	**28**	**10**	**5**	**40**	**3**	**5**	**8.5**

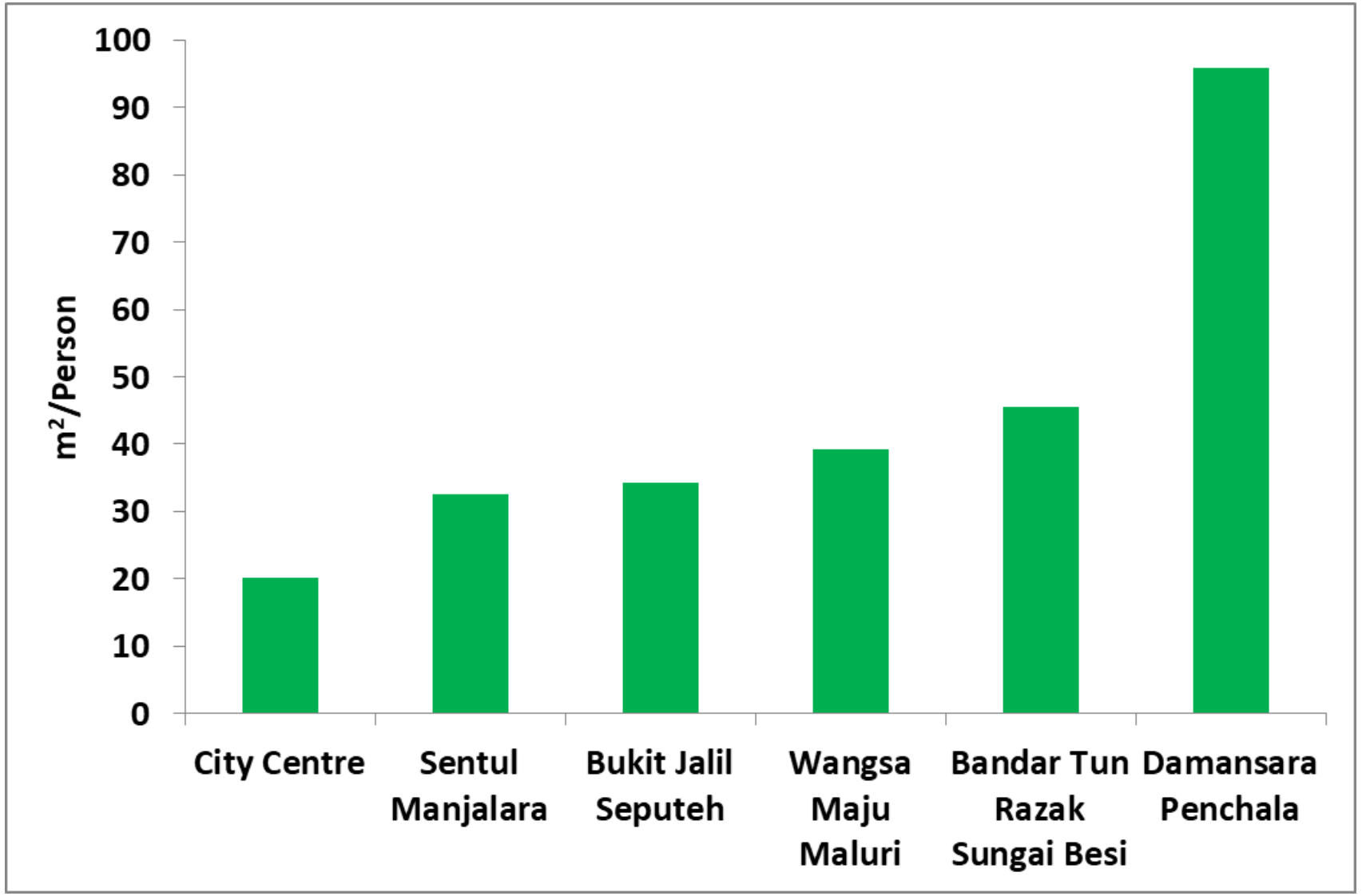
Green Space By Strategic Zones

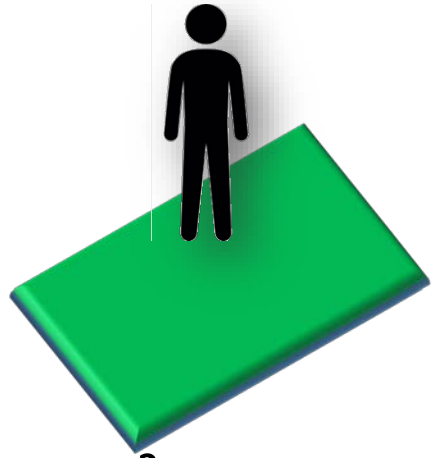


Land use covered by green



Green Space Per Capita



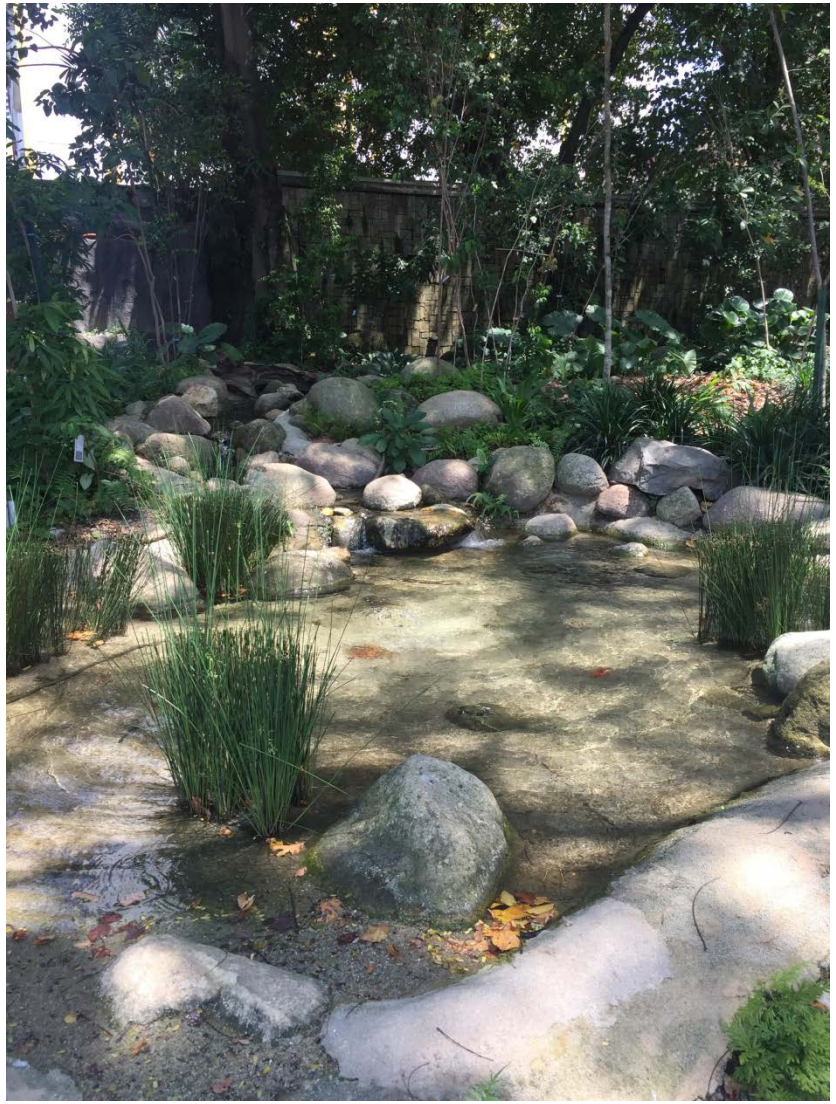


45 m^2/person

WHO standard 9m^2-50m^2

Implication of the results

- Useful for making policies to maintain and/or increase green cover in KL- Low Carbon City Blueprint
- 25 specific programmes were suggested in the Blueprint
  - Establish canopy cover target
  - Identify new planting space (vacant lands can be converted to pocket parks)



Pocket park in KL city centre

Challenges

- Clouds and shadows on high spatial resolution images
- Trees and shrubs cannot be separated

Future Works

- Results from OO classification can be improved using Lidar data
- Detect green space availability and types in other cities in Malaysia
- Connect fragmented green space
- Calculate ecosystem services of green space (carbon storage and sequestration, pollutant removal etc.)

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Thank You

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Article

Satellite Images for Monitoring Mangrove Cover Changes in a Fast Growing Economic Region in Southern Peninsular Malaysia

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