



Urban land use/cover mapping using ALOS AVNIR-2

Ronald C. Estoque, Yuji Murayama, and Koko Lwin

Division of Spatial Information Science

University of Tsukuba, Japan

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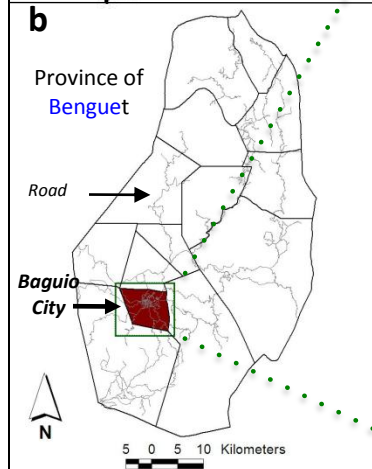
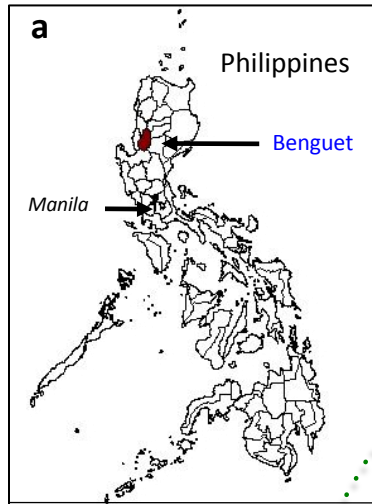
1. Urban land use/cover mapping in Baguio:
A hill station city in the Philippines
2. Multispectral Classification of ALOS AVNIR-
2 for Human Settlement Mapping in South
East Asia Cities

1. Urban land use/cover mapping in Baguio: A hill station city in the Philippines

- **Objective**

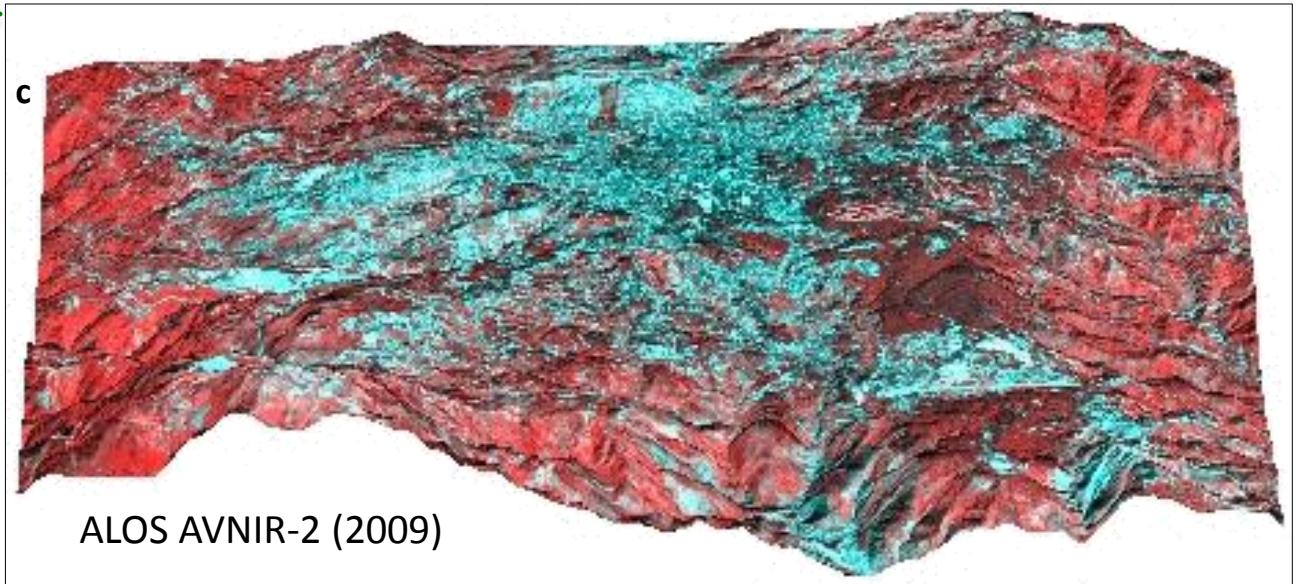
To map the land use/cover of Baguio and explore its urban development pattern.

Study area: Baguio city



- Approximate area
 - 57 sq. km
- Temperature
 - lowest = 6.3°C (January 18, 1961)
 - highest = 30.4°C (March 15, 1988)
 - ave. mean = 15–23°C
- formally established in 1909
- it was envisioned to accommodate up to 25,000 people only

Source: [Saldivar-Sali & Einstein \(2007\)](#); [Basilan & Vicente \(2008\)](#)



- protection and conservation of the ridges, hilltops and forest resources
 - was emphasized in the plan for Baguio ([Crossette, 1999](#); [Gutierrez and Cariño, 2009](#); [Reed, 1999](#))

Study area: Baguio city

continued...

- However, the population of Baguio has grown to at least 301,926 (NSO, 2007)
 - greatly surpassing the maximum number of people it was envisioned to accommodate
- Its growth has been rapid since the 1980s
 - It is now one of the highly urbanized cities in the Philippines
 - Unfortunately, rapid urbanization and population growth are affecting the city's natural environment

Highly urbanized hill



Traffic condition at the CBD



Burnham park



Outside CBD



Land use/cover mapping

- Data

Data	Date	Scale/ Resolution	Source
1. RS image ALOS AVNIR-2	January, 2009 (dry season)	10 m	JAXA
2. Land use map of Baguio	2002	1:50,000	Baguio city, Philippines
3. Ground truth data	2010 & 2011	N/A	Field survey
4. QuickBird image	2009	0.67m	Google Earth

- Methods

- Maximum likelihood supervised classification
 - Ground truth survey
 - Training sites and signature development

Land use/cover mapping

- Methods

Land use/cover classification scheme

Land use/cover types	Descriptions
Built-up	Including concrete structures like buildings, houses, roads, bridges, airport, and others.
Forest	Including thickly forested areas with Pine trees and broadleaved trees.
Brushland	Including sparsely vegetated areas, bushes/scrubland, grassland, scattered trees mixed with scrubland especially in the very steep areas.
Cropland	Including areas being utilized for agricultural activities particularly for growing cash crops like vegetables.

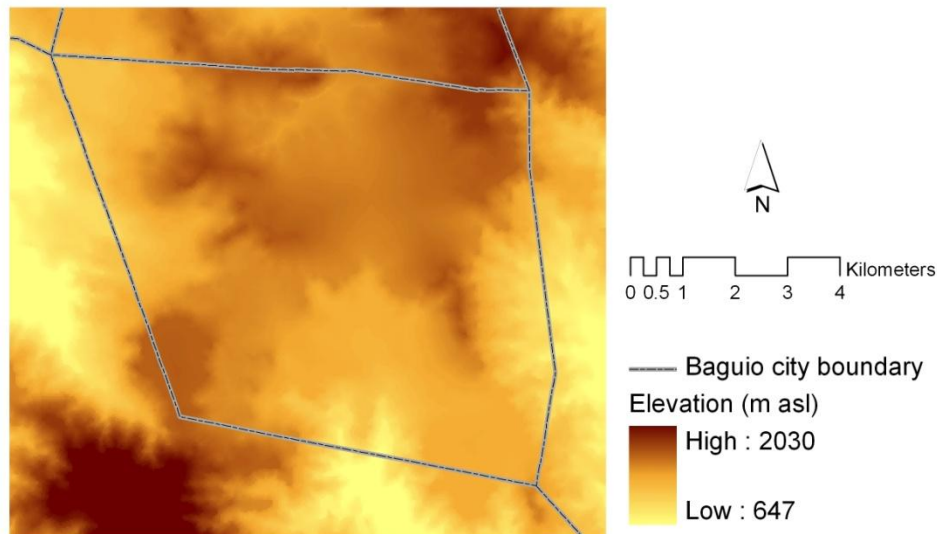
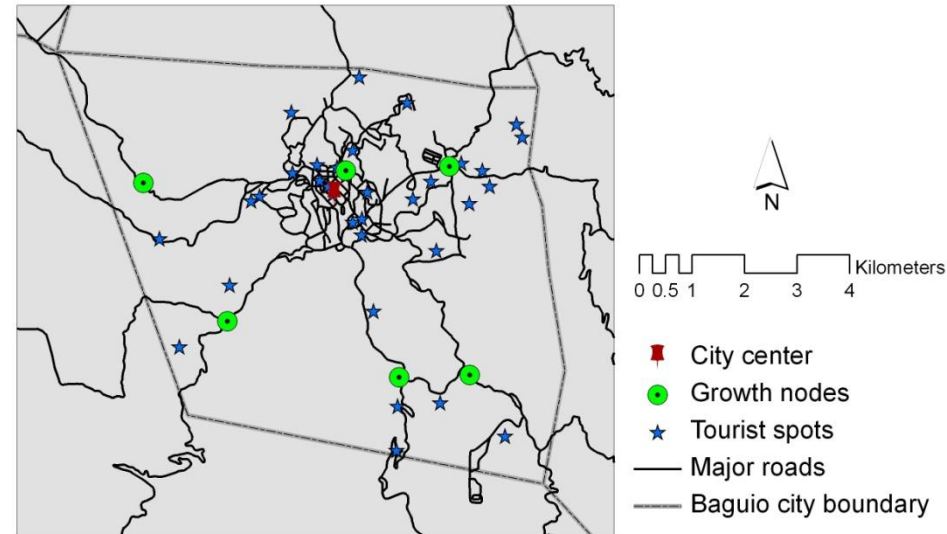
Exploring urban development pattern

Data

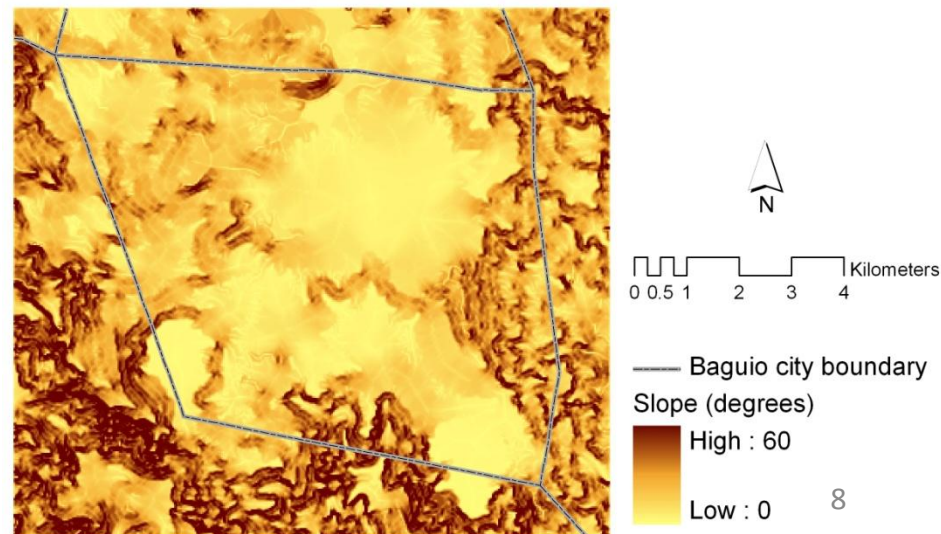
- Map of developed areas
 - Extracted from the land use/cover map
- Maps of spatial factors
 - City center, growth nodes, tourist spots, major roads, elevation and slope

Methods

- Buffering - city center, growth nodes, major roads
 - 200m buffer size
- Reclassification – elevation and slope
 - 30 classes
- Regression analysis
 - Density of develop area versus the spatial factors



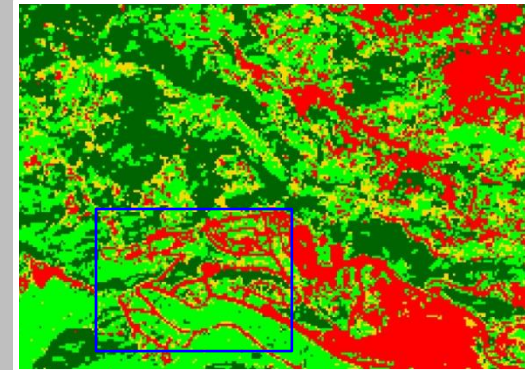
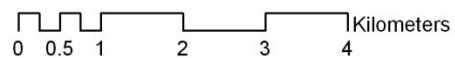
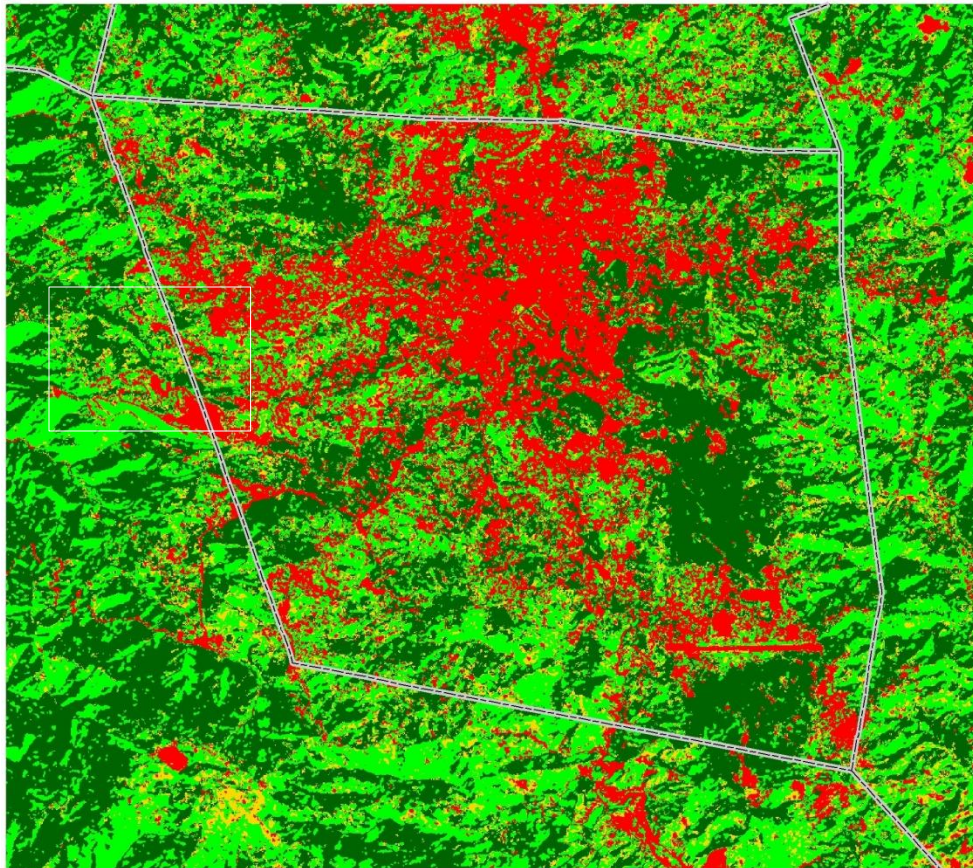
Elevation



Slope

• Results

2009 Land use/cover map of Baguio



2009 QuickBird satellite image
(Source: Google Earth)

- Results

Accuracy assessment using 312 ground truth points

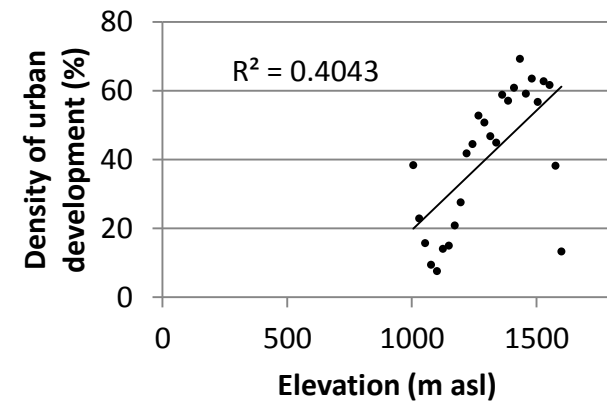
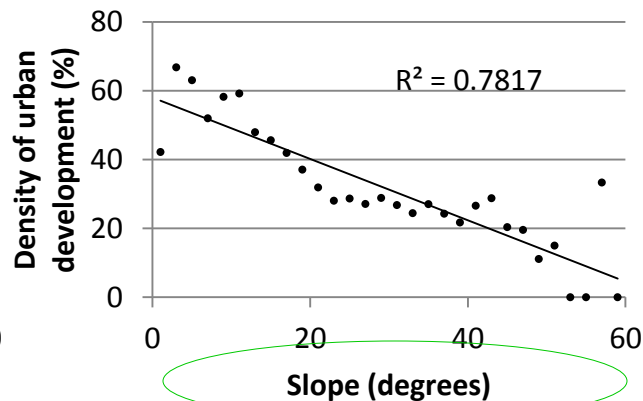
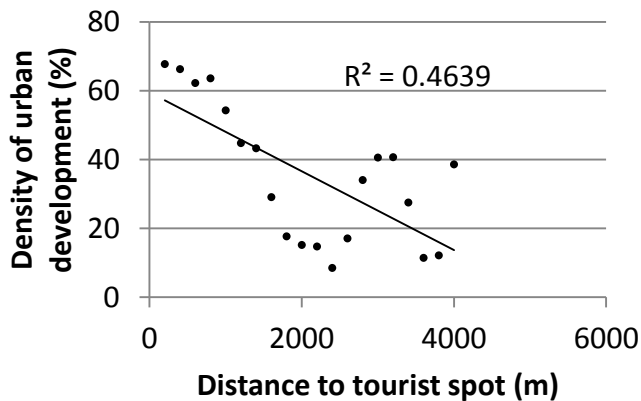
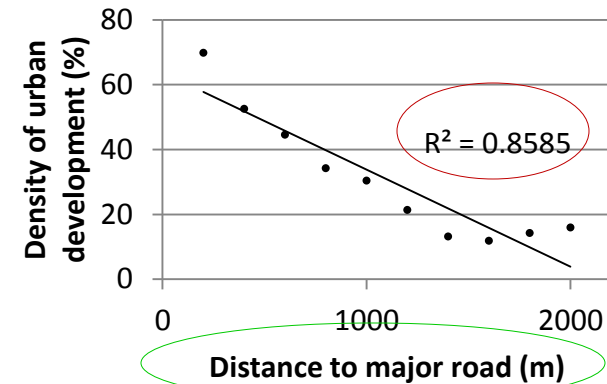
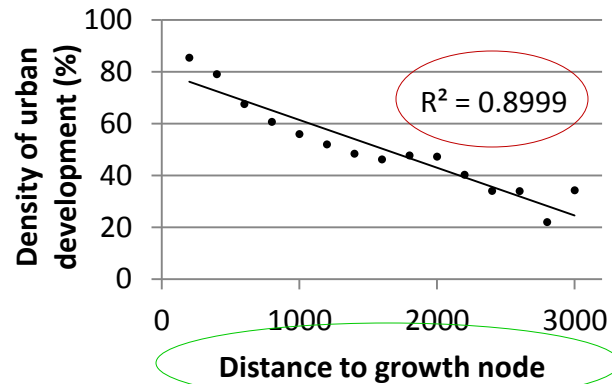
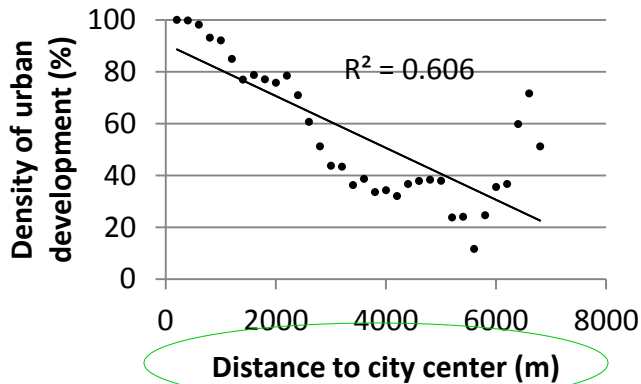
Classified data	Reference data				Total	User's accuracy (%)
	Built-up	Forest	Brushland	Cropland		
Built-up area	119	0	0	5	124	95.97
Forest	0	68	4	0	72	94.44
Brushland	3	5	51	3	62	79.03
Cropland	8	1	3	42	54	77.78
Total	134	74	56	48	312	
Producer's accuracy (%)	89.55	91.89	87.5	85.42		

Overall Classification Accuracy (%) = 89.10

Overall Kappa Statistics = 0.847

- Results

Relationship of the density of urban development with the spatial factors

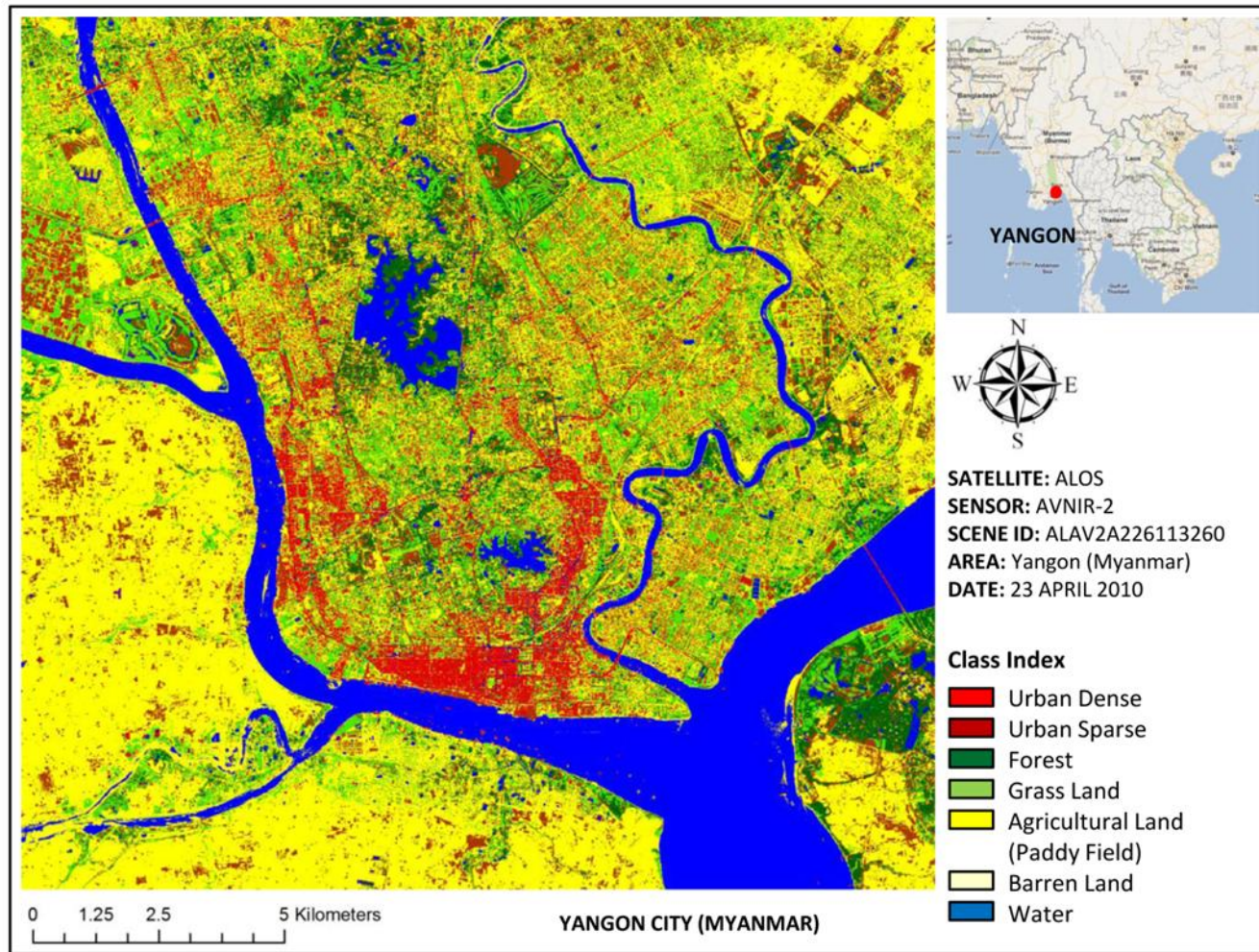


2. Multispectral Classification of ALOS AVNIR-2 for Human Settlement Mapping in South East Asia Cities

- **Objective**

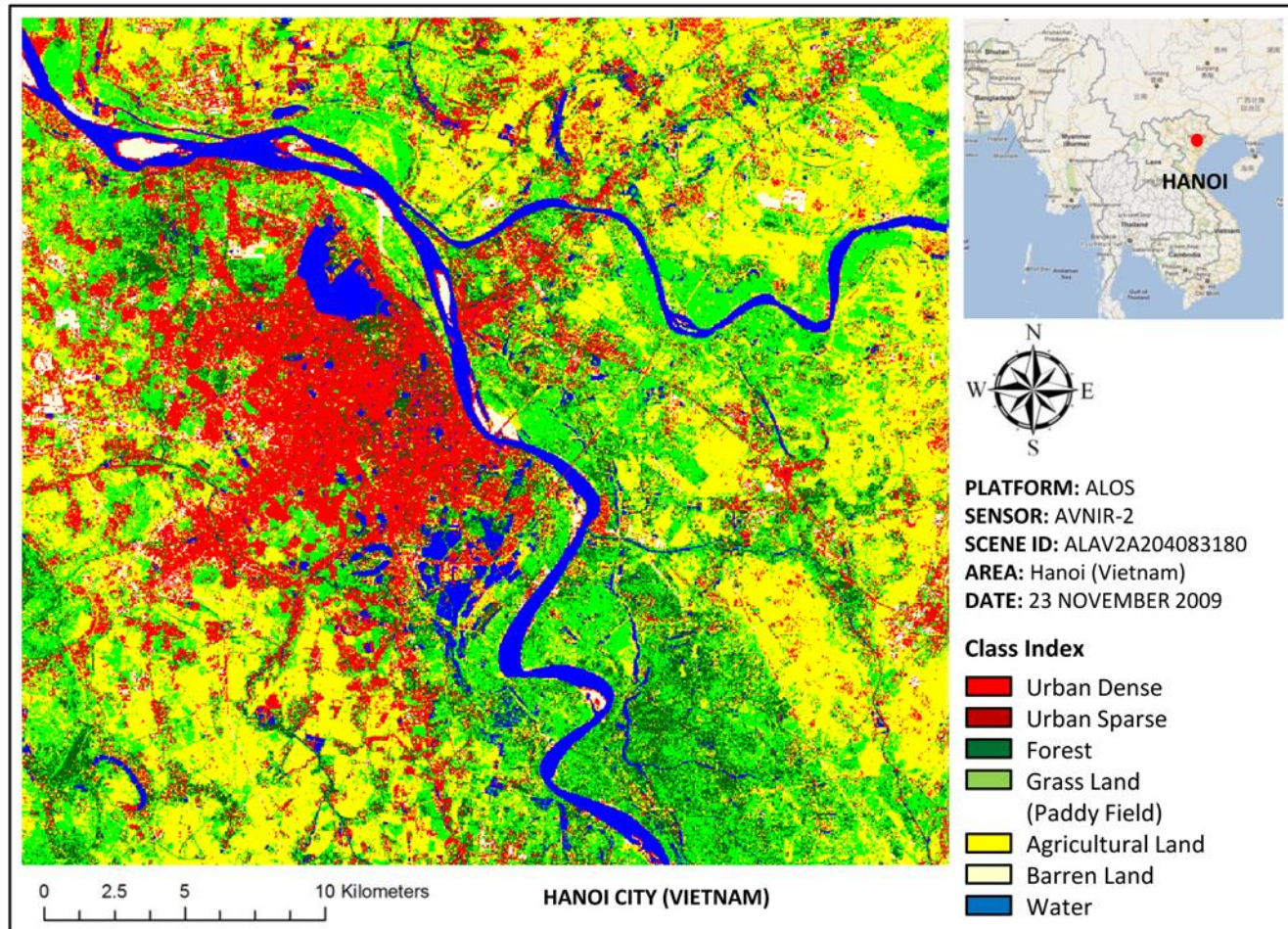
To identify human settlement areas for population estimation in Yangon, Myanmar and Hanoi, Vietnam.

Yangon, Myanmar



Source: Y. Murayama and K. K. Lwin, "Population estimation of rapidly growing cities in Southeast Asia using GIS/RS", Grant-in-Aid for Scientific Research, Japan Society of Promotion of Science and Technology 2010.

Hanoi, Vietnam



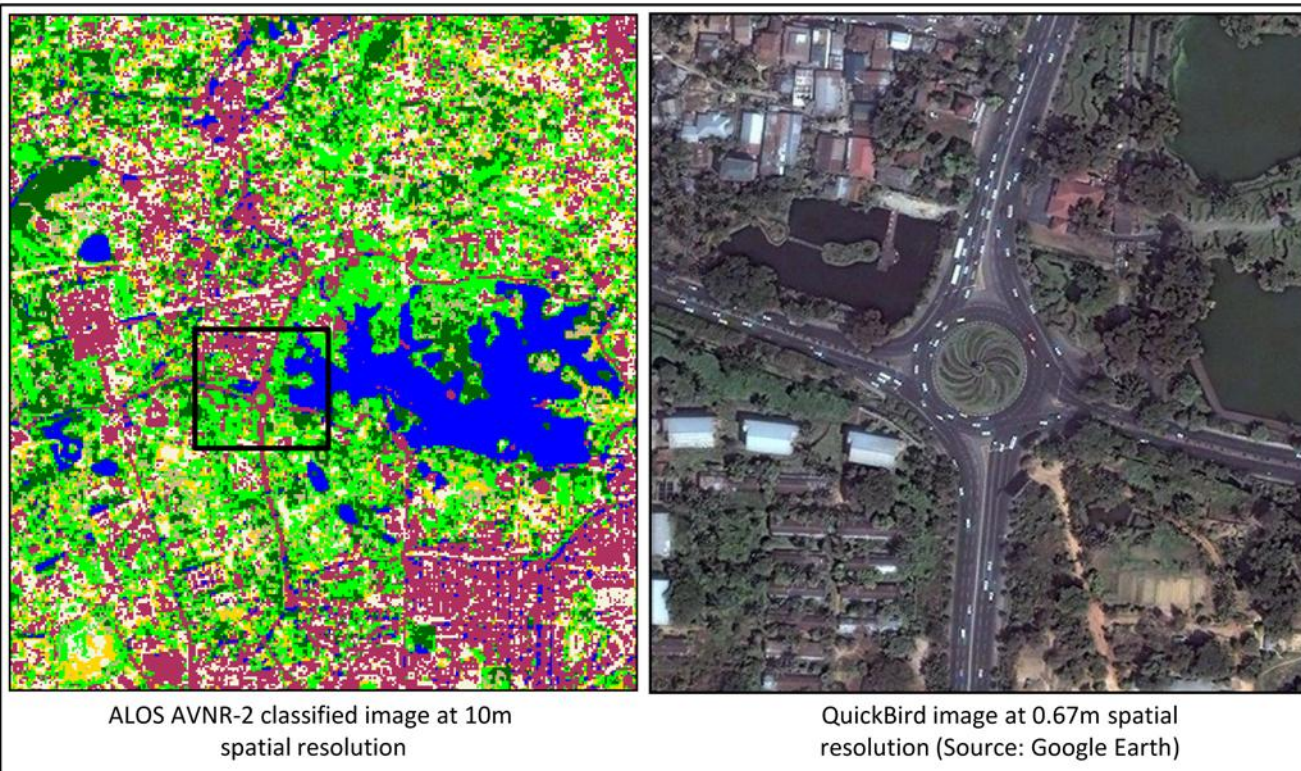
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Accuracy Assessment of Classified Image with High Resolution Satellite Image (Google Earth)



Source: Y. Murayama and K. K. Lwin, “Population estimation of rapidly growing cities in Southeast Asia using GIS/RS”, Grant-in-Aid for Scientific Research, Japan Society of Promotion of Science and Technology 2010.

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- Overall accuracy for Yangon and Hanoi

Yangon

Overall Classification accuracy	89.84%
Overall Kappa Statistics	0.8622

Hanoi

Overall Classification accuracy	86.67%
Overall Kappa Statistics	0.8314

Summary

- Using ALOS AVNIR-2 and multispectral classification
 - urban land use/cover maps for Baguio, Yangon and Hanoi were mapped
 - spatial distribution patterns of built-up and human settlements were clearly identified in all 3 cities
 - 10m spatial resolution was able to capture features like major roads
- Accuracy assessment
 - errors were observed especially between forest and brushland, and built-up and cropland
 - spectral confusion due to mixed pixels
 - shadows also caused errors in the classification
- Nevertheless, the classified land use/cover maps have relatively high accuracy.

Thank you very much for your
attention...

どうもありがとうございました...



References

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