Relationship between non-stationarity of land-cover change process and error due to allocation
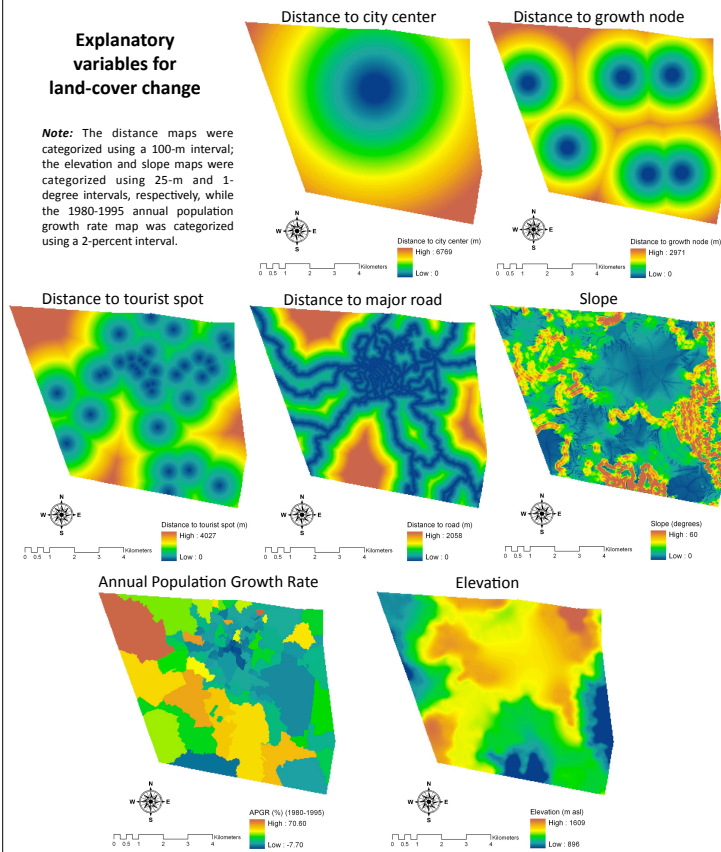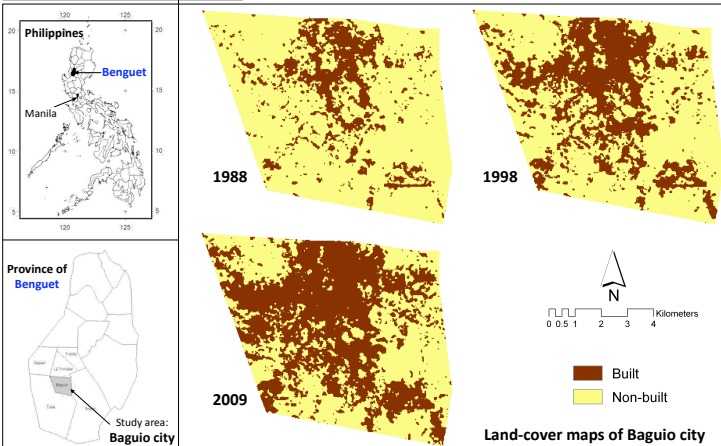
Ronald C. Estoque

Division of Spatial Information Science, Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan
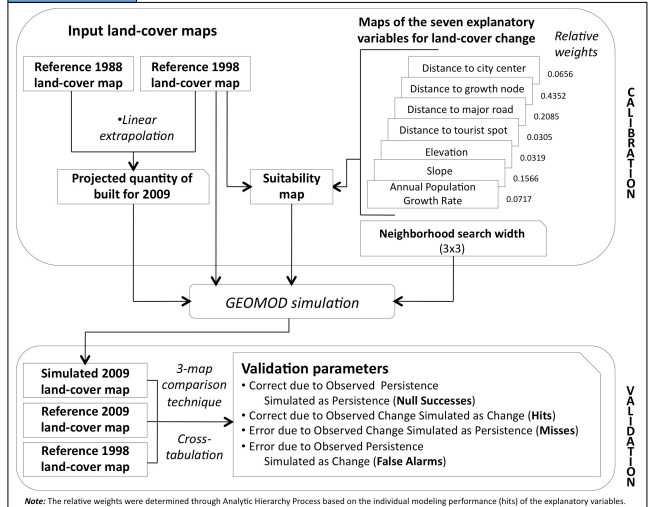
Email address: purplebee80@yahoo.co.uk

Introduction

❖ In the context of this study, non-stationarity of land-cover change process (gain of built) exists when the change is not stationary along the gradients of the underlying categorized explanatory variables across the calibration (1988-1998) and simulation (1998-2009) intervals. Non-stationarity+ is characterized by an increase in the gains of built along the gradients of the categorized explanatory variables across the calibration and simulation intervals, while non-stationarity– is characterized by a decrease.

❖ The purpose of this study is to examine the relationship between non-stationarity (+ and –) of land-cover change process and the sources of error due to allocation, namely misses and false alarms.
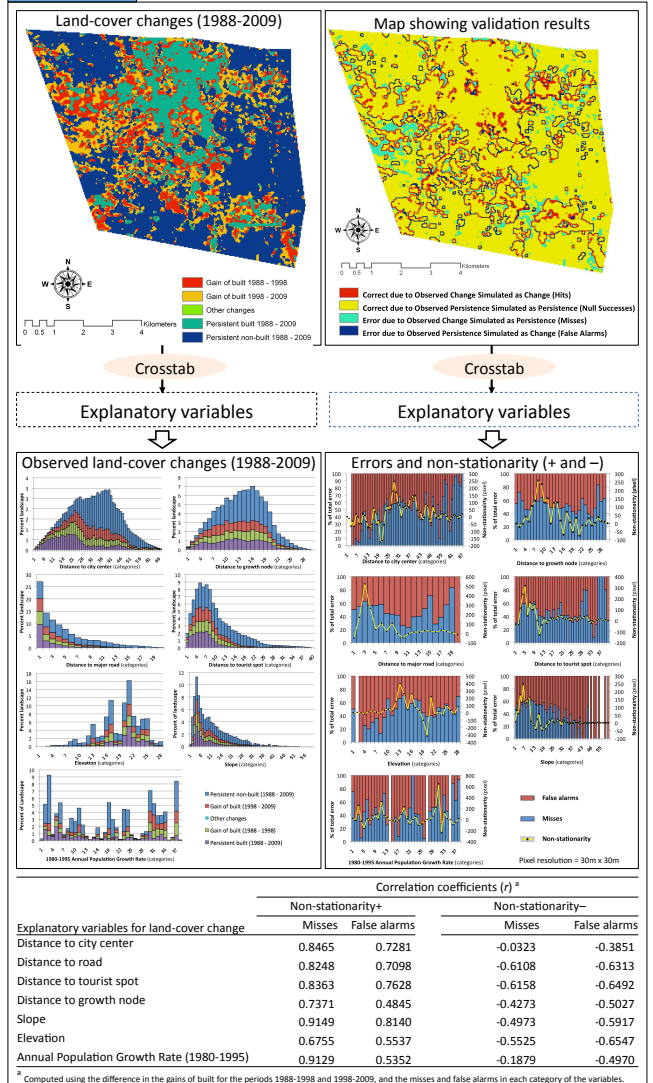
Study area and data

Land-cover maps of Baguio city

- Built
- Non-built

1988 · 1998 · 2009

Explanatory variables for land-cover change

Note: The distance maps were categorized using a 100-m interval; the elevation and slope maps were categorized using 25-m and 1-degree intervals, respectively, while the 1980-1995 annual population growth rate map was categorized using a 2-percent interval.

Distance to city center · Distance to growth node · Distance to tourist spot · Distance to major road · Slope · Annual Population Growth Rate · Elevation

Poster presented during the CSIS Days 2012 at the University of Tokyo, Japan, November 2-3, 2012.

Methods

Note: The relative weights were determined through Analytic Hierarchy Process based on the individual modeling performance (hits) of the explanatory variables.

Relative weights
- Distance to city center 0.0656
- Distance to growth node 0.4352
- Distance to major road 0.2085
- Distance to tourist spot 0.0305
- Elevation 0.0319
- Slope 0.1566
- Annual Population Growth Rate 0.0717

Validation parameters
- Correct due to Observed Persistence Simulated as Persistence (**Null Successes**)
- Correct due to Observed Change Simulated as Change (**Hits**)
- Error due to Observed Change Simulated as Persistence (**Misses**)
- Error due to Observed Persistence Simulated as Change (**False Alarms**)

Results

Land-cover changes (1988-2009)
- Gain of built 1988 - 1998
- Gain of built 1998 - 2009
- Other changes
- Persistent built 1988 - 2009
- Persistent non-built 1988 - 2009

Map showing validation results
- Correct due to Observed Change Simulated as Change (Hits)
- Correct due to Observed Persistence Simulated as Persistence (Null Successes)
- Error due to Observed Change Simulated as Persistence (Misses)
- Error due to Observed Persistence Simulated as Change (False Alarms)

Observed land-cover changes (1988-2009) · **Errors and non-stationarity (+ and –)**

Pixel resolution = 30m x 30m

	Correlation coefficients (r) [a]			
	Non-stationarity+		Non-stationarity–	
Explanatory variables for land-cover change	Misses	False alarms	Misses	False alarms
Distance to city center	0.8465	0.7281	-0.0323	-0.3851
Distance to road	0.8248	0.7098	-0.6108	-0.6313
Distance to tourist spot	0.8363	0.7628	-0.6158	-0.6492
Distance to growth node	0.7371	0.4845	-0.4273	-0.5027
Slope	0.9149	0.8140	-0.4973	-0.5917
Elevation	0.6755	0.5537	-0.5525	-0.6547
Annual Population Growth Rate (1980-1995)	0.9129	0.5352	-0.1879	-0.4970

[a] Computed using the difference in the gains of built for the periods 1988-1998 and 1998-2009, and the misses and false alarms in each category of the variables.

Conclusions

❖ In this study, non-stationarity+ had better linear relationship with misses than with false alarms, while non-stationarity– had stronger linear relationship with false alarms than with misses.

❖ Future plan: Explore how the findings can be used to improve the quality of the calibration process for more accurate modeling results.