



Modeling Asian Urban Dynamics: Impacts of Economic Globalization on the Emergence of Desakota Regions in Taipei Metropolitan Area

Bing Sheng Wu

Department of Geography
Texas A&M University



Research Background

Characteristics of Asian urbanization:

- Emergence of the **desakota** region
 - Rapid urbanization takes place in **rural areas with dense population**
 - **No clear-cut division** between urban and rural areas
- Tightly interlock with **global/local economic developments**



Objectives

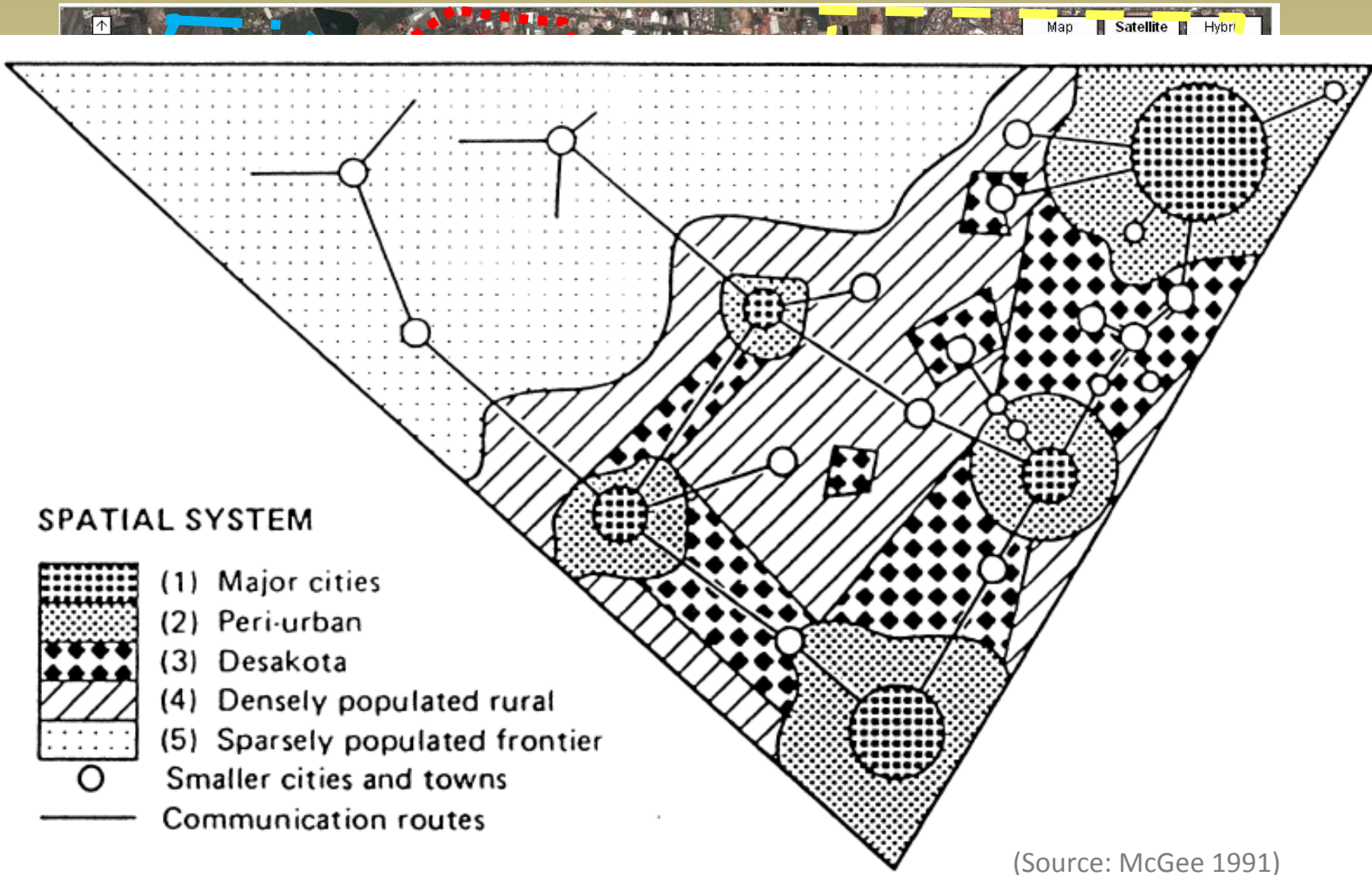
- Explore how **economic globalization** interacts with local economic developments and affects urbanization process/ urban pattern in Asia
- Incorporate GIS /remote sensing technologies, and socio-economic data to develop a **CA-based urban model** and simulate the dazzling Asian urban dynamics



The desakota model: an overview

- The **conceptual model** is proposed by McGee and Ginsburg in 1991
- “Desakota” is coined from two **Indonesian terms** -- “desa (village)” and “kota (town)”
- Representing urbanization processes taking place in **densely populated rural** regions
- An **intensive mixture** of agricultural and non-agricultural activities

An ideal desakota spatial system





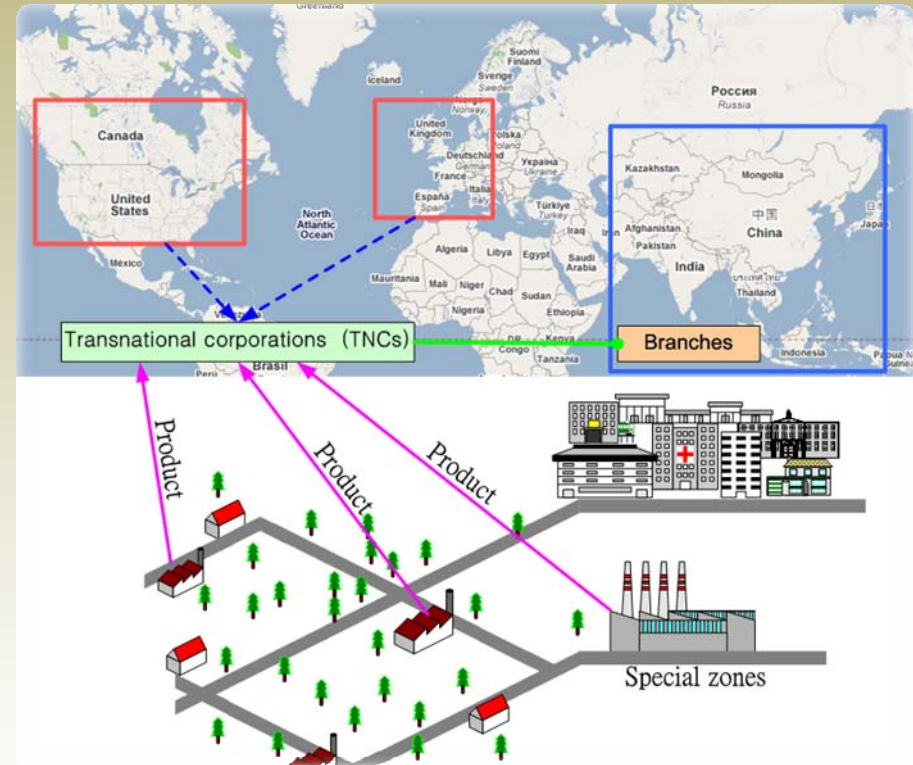
Driving factors for the desakota regions

- **Sectoral shifts**
 - **Decrease** of agriculture sector
 - **Increase** of manufacturing / service sectors
- **Population dynamics**
 - Rapid population growth in **rural areas**
- **Well-developed infrastructure**
 - **road network** between urban and rural



Impacts of economic globalization

- **International division of labor**
 - Developed countries
 - Transnational corporations (TNCs)
 - Developing countries
 - Small and medium enterprises (SMEs)
- **Capital flows in Asia**
 - Foreign direct investments (FDIs)
 - Subcontract /outsourcing





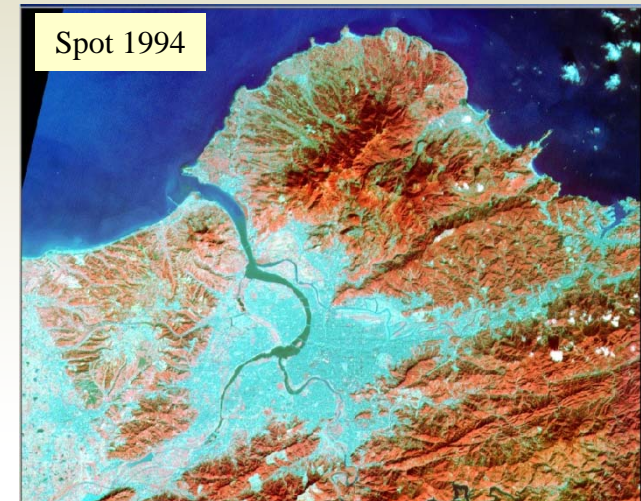
Data acquired

- Remote sensing data

Image ID	Type	Date	Coordinate System
1	SPOT	1993	TM2
2	Landsat	2001	TM2
3	Landsat	2008	TM2

- Statistical data set

- Population (1981 ~ 2007)
- Economic activities (1981 ~ 2007)
- FDI data (1981 ~ 2007)



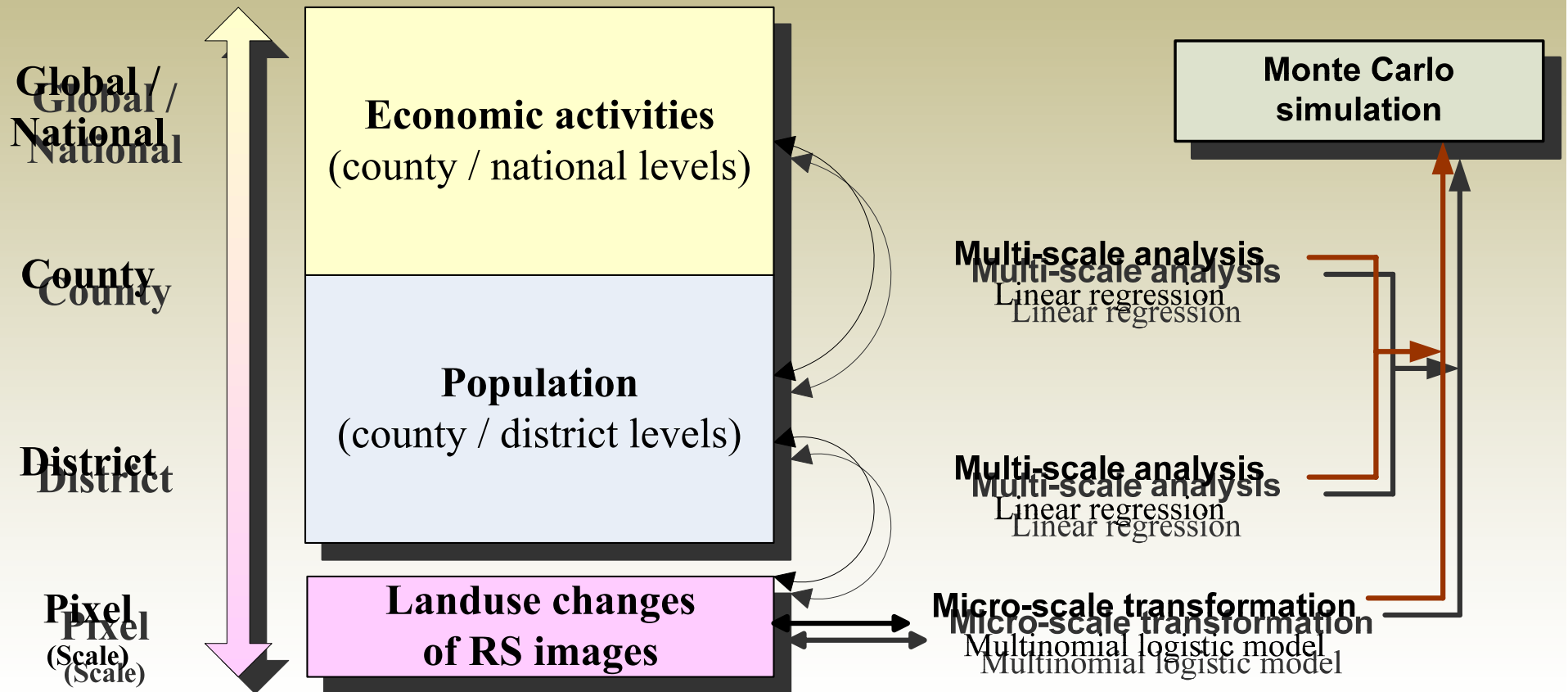


Methodology

- **Multi-scale Analysis**
 - Hierarchically integrate global/local driving forces.
- **Micro-scale transformation**
 - Probability of transformation from non-urban to urban pixels
- **Monte Carlo Simulation**
 - Conjunction of multi-scale processes and micro-scale transformation into CA simulation



Methodological Framework





Multi-scale analysis

- Linear relationship between **population** and global/ local **economic activities**

$$Pop_{county} = f(Eco_{pri}, Eco_{sec}, Eco_{ter}, FDI_{manu}, FDI_{serv})$$

$$Pop_{district} = Pop_{county} \times w$$

- Linear relationship between **population growth** and **converting pixels** (non_urban \rightarrow urban)

$$Area_{non_urban \rightarrow urban} = \alpha + \beta \times \Delta Pop_{district}(t \rightarrow t+1)$$



Micro-scale transformation

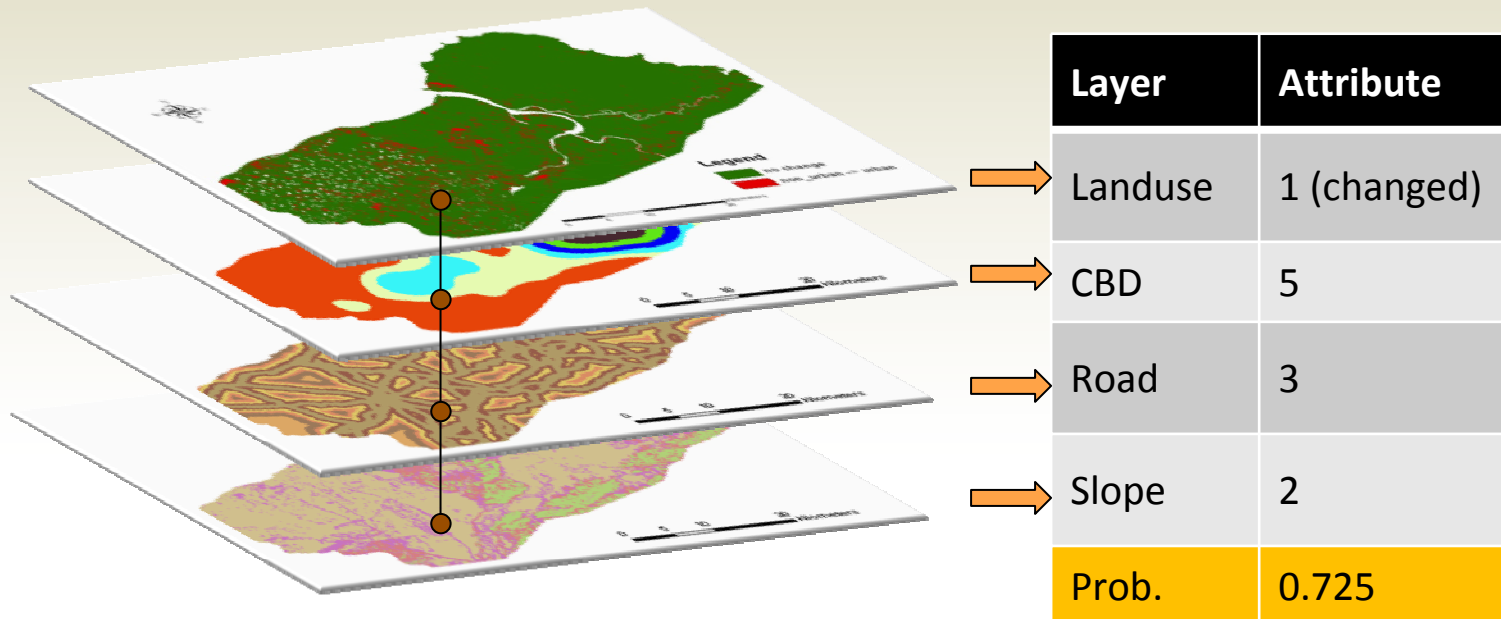
- **Land cover change**
 - Non_urban → urban pixels
- **Variables**
 - Distance to economic centers
 - Distance to roads
 - Terrain (slope)



Multinomial logistic model

- To estimate the probability of the conversion from **non-urban** to **urban** pixels

$$\text{Prob}_{non_urban \rightarrow urban} = \frac{e^y}{1 + e^y} \quad \text{where } Y = \alpha + \sum_{i=1}^n \beta_i X_i$$





Monte Carlo simulation

- Linkage between **multi-scale analysis** and **micro-scale transformation**
- **Randomly** assign a float value (0 ~1) as a probability ($\text{Prob}_{\text{rand}}$) to i_{th} non-urban pixel
- If $\text{Prob}_{\text{rand}}(i) < \text{Prob}_{\text{non_urban}}(i)$, the i_{th} non-urban pixel will change its status.

0.60	0.87	0.43
0.92	0.19	0.24
0.69	0.12	0.40

$\text{Prob}_{\text{rand}}$

0.64	0.88	0.12
0.23	0.33	0.89
0.59	0.93	0.43

$\text{Prob}_{\text{non_urban} \rightarrow \text{urban}}$

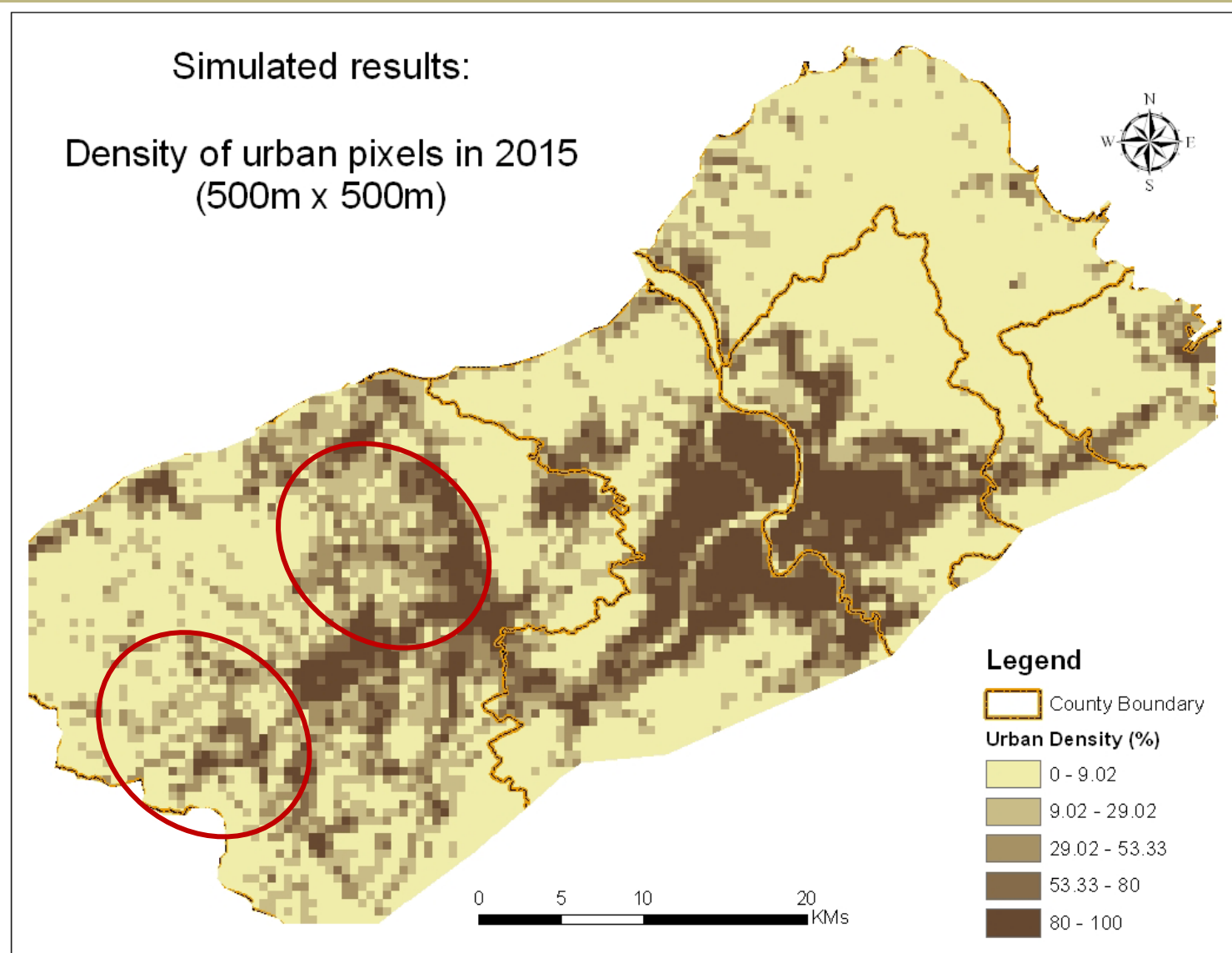
changed	changed	
	changed	changed
	changed	changed

Results

Blue: urban pixels **Brown:** non_urban pixels



Simulation Results





Conclusions

- The combination of multi-scale factors reveals a new approach modeling Asian **urbanization process with the impact of globalization.**
- Desakota regions act as growing generators in Asian urban dynamics.
- **FDI inputs** plays a critical role in the desakota regions and affect urban growth in Asian countries.



Thank you

