Definitions and Concepts for Secondary Cities

Keith C. Clarke
UC Santa Barbara
Department of Geography
What is mapping?

• Fiat Features
  – Toponyms
    – Buildings
    – Land use
    – Places of interest
    – Government, institutions, parks, schools, hospitals etc.
  – Cadastre

• Visible Geometry
  – Roads, streets, highways
  – Power and communications infrastructure, airports
  – Water features and resources
A changing paradigm

• Authoritative mapping: Central agency, public or military funding, systematic coverage, standardized products, often closed distribution

• Volunteered Geographic Information: Citizen scientists, no funding, ad hoc coverage, bottom-up procedures, online open resources

• New mapping technologies: drones, LiDAR, open imagery and software, SFM methods, mobile devices and social media as sensors

• Time series now far more common
(Almost) Instant 3D Mapping
Chiang Mai, Thailand (Population c400,000)
What is dynamic mapping?

MAPPING

• Change in extent
• Change in features
• Change in class
• Change in fiat descriptions

AND

• Forecasting, Predicting, Understanding these changes
• Often requires models and historical data for validation
Mapped dynamics

1800
Urban Growth and Land Cover Change In Chiang Mai and Taipei: Results From The SLEUTH Model

S. Sangawongse¹, C. H Sun² and B. W. Tsai³

¹Department of Geography, Faculty of Social Sciences, Chiang Mai University, Thailand 50200
²Department of Geography, National Taiwan University, Taiwan, R. O. C.
³Department of Geography, National Taiwan University, Taiwan, R. O. C. E-Mail: somporn@chiangmai.ac.th

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EXTENDED ABSTRACT

SLEUTH is a modified cellular automata (CA) model which consists of an urban growth sub model and a land cover change transition sub model. The urban growth model is the main component of SLEUTH, which is tightly coupled with the land cover change transition model. This model was chosen to calibrate urban growth in two

With a suitably calibrated model, the next phase of research is to use it to explore alternative futures by adjusting some of the key parameters. It is also intended to use the urban extents from other years in the calibration to observe the model sensitivity to temporal data sets. At this stage the model moves from a descriptive tool to one that could help facilitate deliberation about alternative futures.

Figure 3. Urban growth in Chiang Mai study area between 1952-1989-2000
What are secondary cities?

- Cities dominated by primate cities
- Between 500,000 to 3 million inhabitants
- Number of SCs increasing rapidly “long tail”
- Often unknown outside of their national or regional context, less mapped
- Undergoing historic rates of urbanization and growth due to rural-to-urban migration, increased natural growth and international migration
- Perhaps least able to deal with urban problems
Zipf’s Rank-Size Rule by Nation

\[ P_n = P_1 \times \frac{1}{n} = P_1 \times n^{-1} \]  \hspace{1cm} \cdots \cdots (1)

- \( P_1 \): Population of the largest city
- \( P_n \): Population of the \( n \)th largest city

Exceptions are Primacy
Zip within countries

Rank-Size for Chinese Cities

Population

<table>
<thead>
<tr>
<th>City</th>
<th>Rank</th>
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</thead>
<tbody>
<tr>
<td>Shanghai</td>
<td>1</td>
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<tr>
<td>Beijing</td>
<td>2</td>
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<tr>
<td>Chongqing</td>
<td>3</td>
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<td>Guangzhou</td>
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<tr>
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<td>Dalian</td>
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<td>Zhengzhou</td>
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Rank-Size Uzbekistan

Population

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<td>Samarkand</td>
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<tr>
<td>Andijan</td>
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<tr>
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<td>Qarshi</td>
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<tr>
<td>Chirchiq</td>
<td>9</td>
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<tr>
<td>Fergana</td>
<td>10</td>
</tr>
</tbody>
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1934-2013
Why dynamic mapping of secondary cities?

• Bulk of future growth in urban extent and population
• Often focus of urbanization ills: flooding, water and power supply, waste and sewage, health, poverty, violence, corruption
• Local governments often weak and ineffective
• Services low, hazards high
• Dynamic mapping essential for triage
Costs/Benefits of dynamic mapping in SC

Examples:
• Assess landslide hazard and move settlements
• Anticipate traffic congestion and air pollution
• Provide sustainable water supply
• Respond to emerging infectious diseases
• Evaluate inequitable or dysfunctional government boundaries
Some Thoughts


• Need 4D GIS to track revisions and changes

• New technologies are an opportunity

• VGI in country is an untapped potential (e.g. Dharavi)

• Many forecasting models now available and their solutions tractable with HPC and Cloud Computing

• How do modeling and planning overlap?

• Urban conversion has a centuries time scale, so consequences are long term
Thanks