Measure Sustainable Cities and Communities based on Indicators on Urbanization

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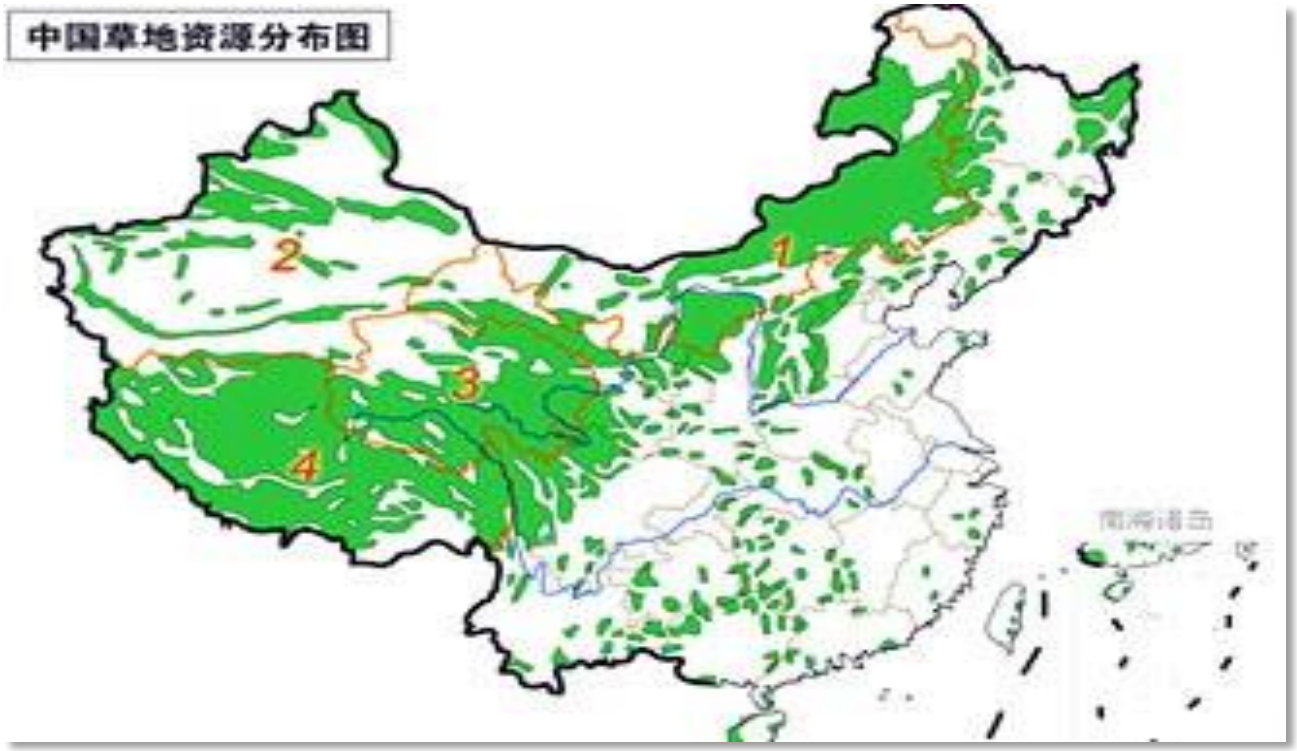
Indicators on Urbanization and SDGs

Survey → Planning → Design → Implement → Maintenance → Assessment

Contents

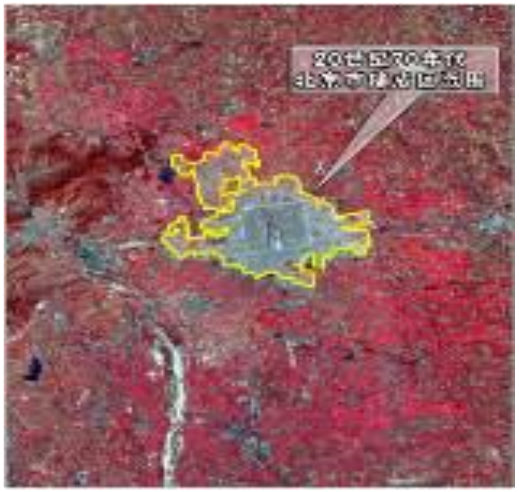
1st Census on Geographic Conditions in China

- Area: China
- Project period: 2013 and 2015



Background

Census on Geographic Conditions



Geographic Conditions

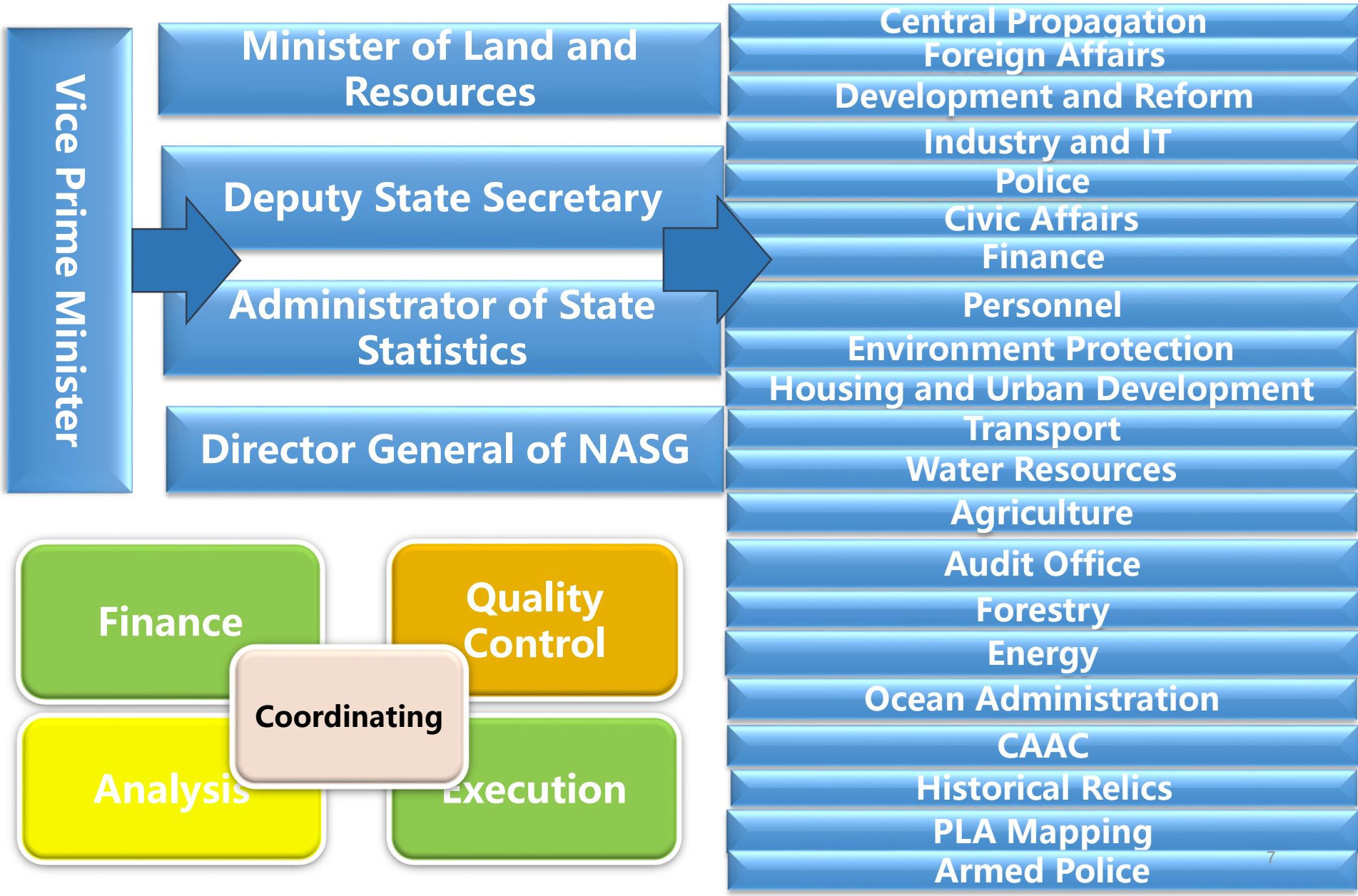
Physical Geography

- Natural Features
- Land Cover

Human Geography

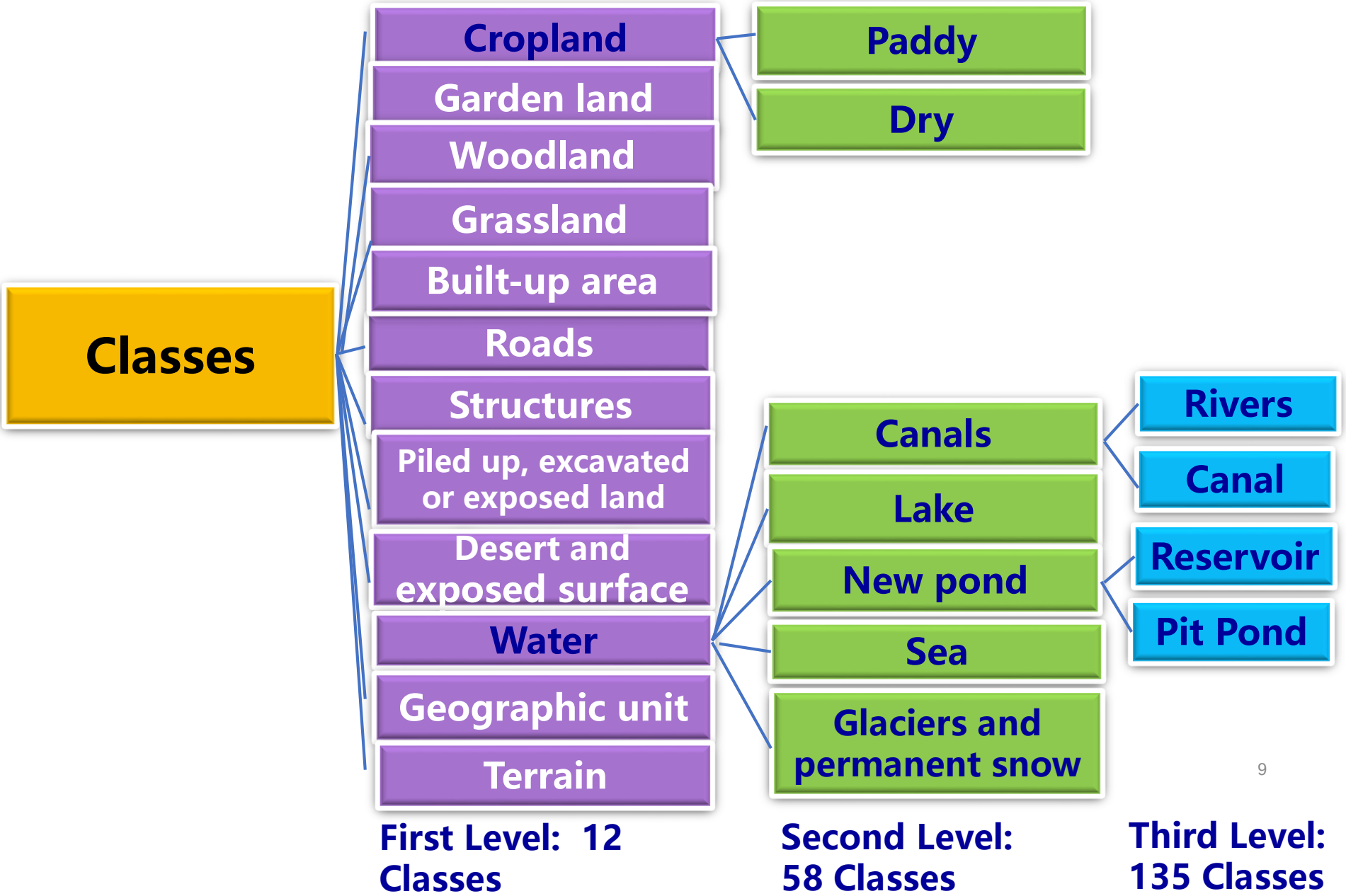
- Man-Made Features
- Social-Economic Data

Project Management



Contents

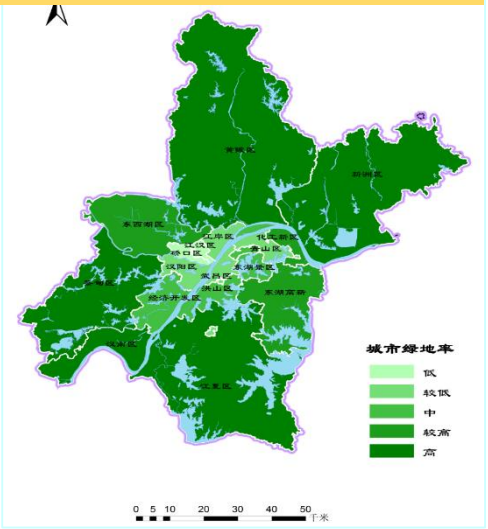
Classification System



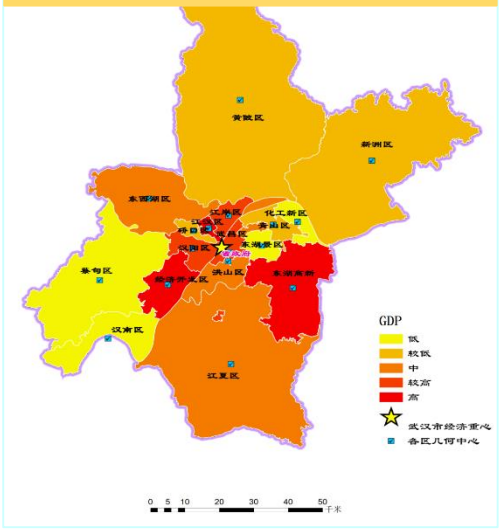
Land Use Classification

Example of Geographic Analyses

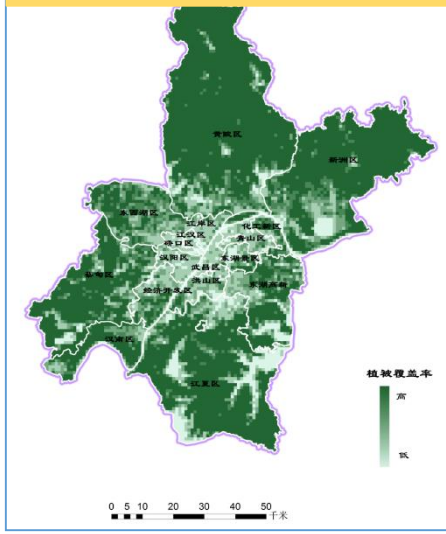
Human Settlement



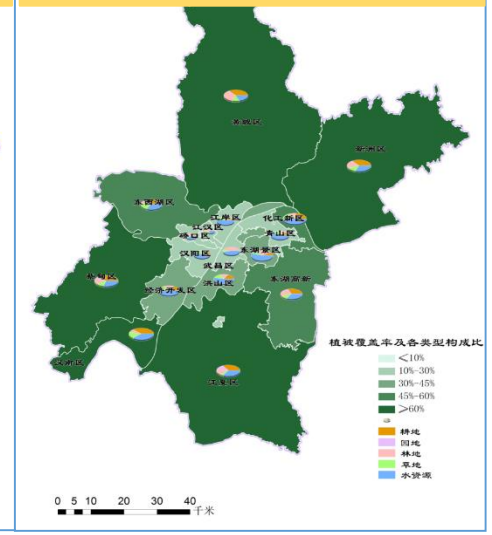
Location Condition



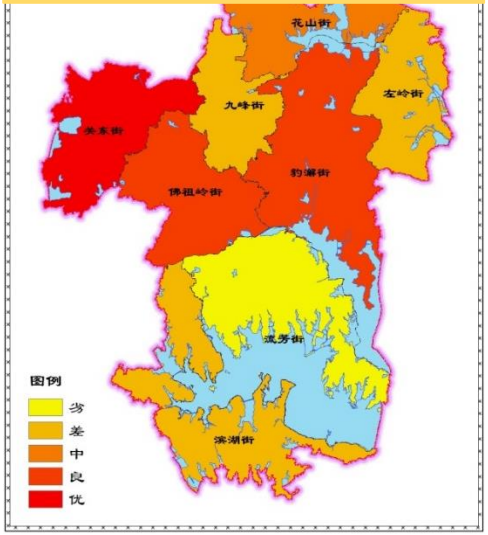
Resources



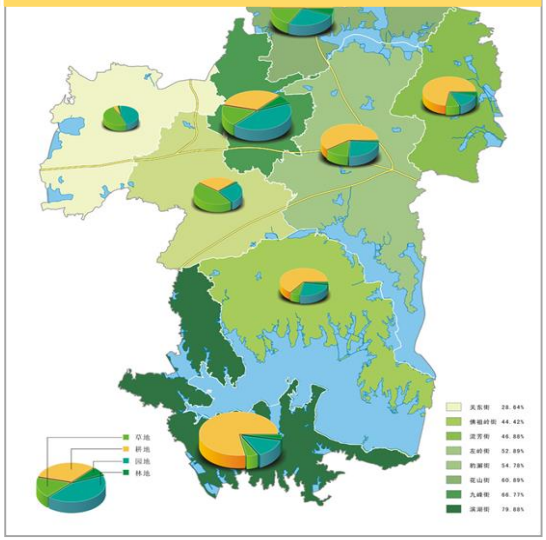
Vegetation Cover



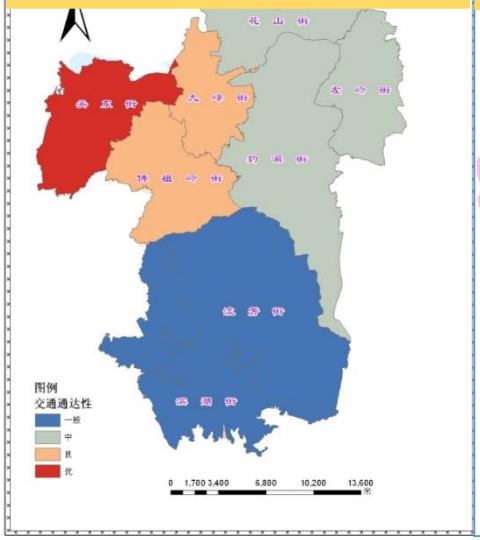
Living Environment



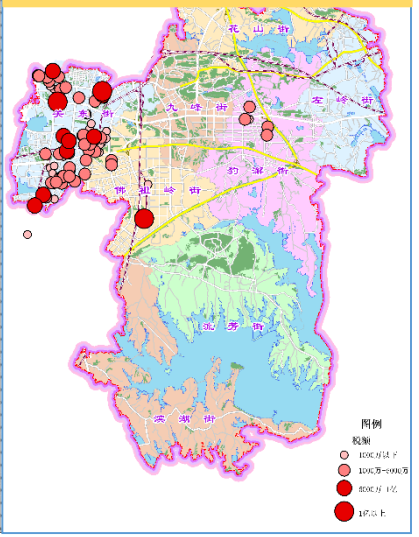
Vegetation Cover



Traffic



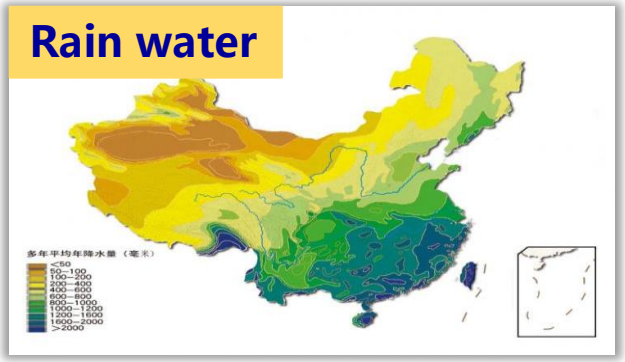
Productivity



Examples of Geographic Monitoring

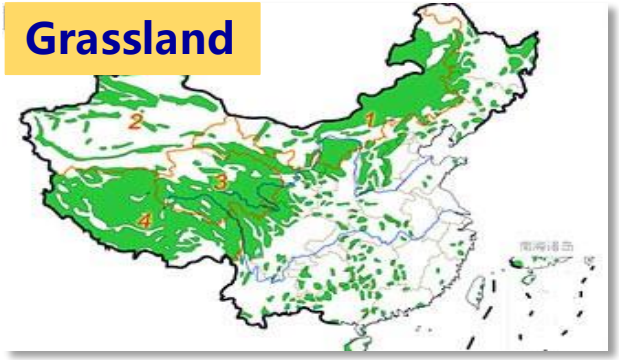
Agricultural land

Rain water



Urbanization

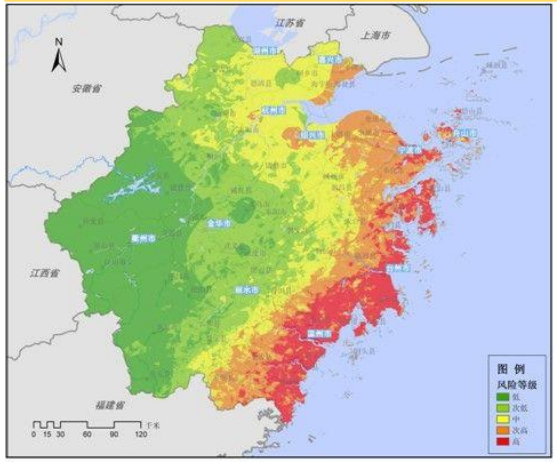
Grassland

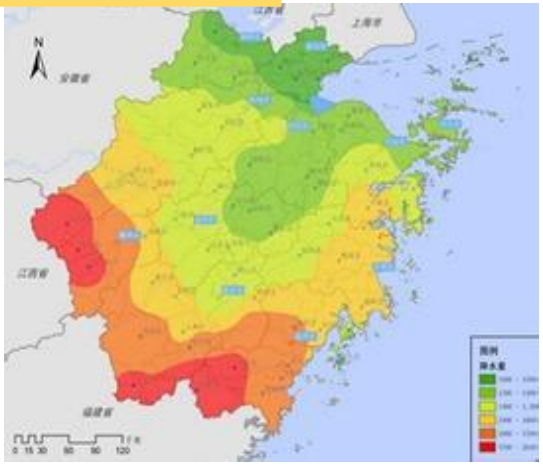


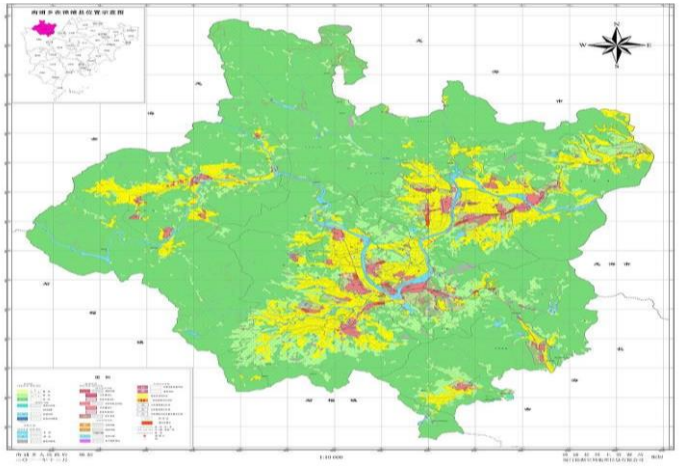
Forest land

Application Examples

Integrated Multi-planning







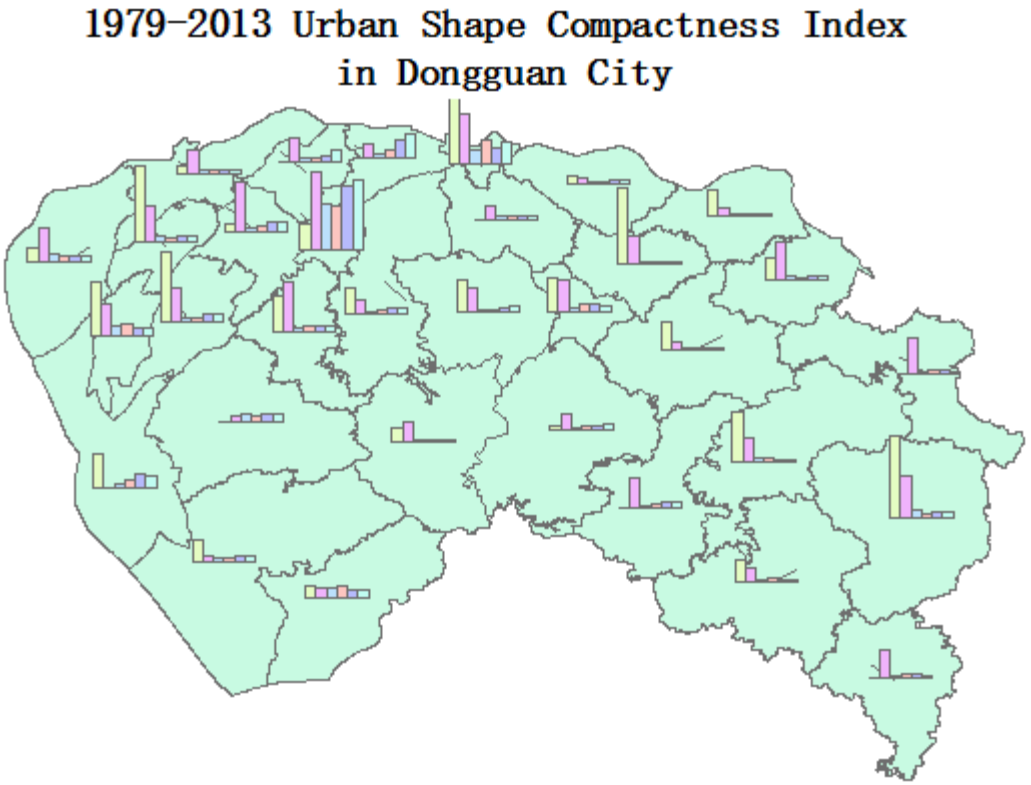
Ecological Auditing

Contents

Indicators on Urbanization

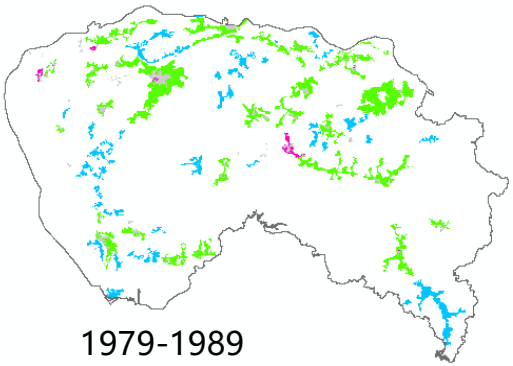
Urban Shape Compactness Index

- $c = \frac{\sum_{i=1}^{n}(\frac{2\sqrt{\pi A_i}}{P_i})}{n^2}$, measure of compactness of urban area's contour
- Higher value indicates higher compactness of Urban Area (denser distribution)

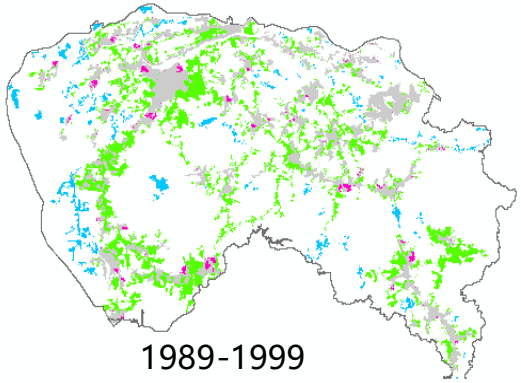


Higher compactness and **denser** urban area distribution in central area

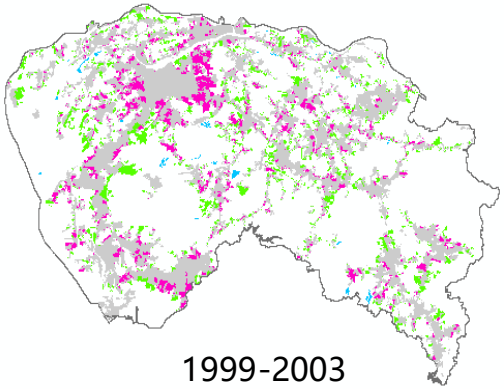
Urban expansion mode



1979-1989



1989-1999

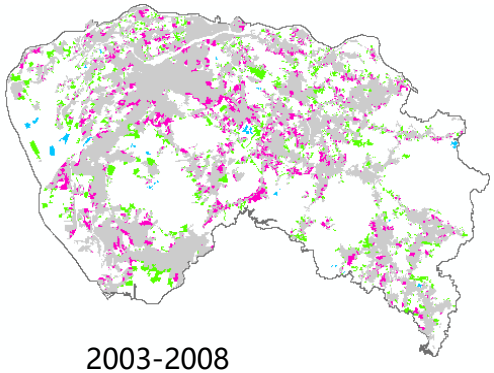


1999-2003

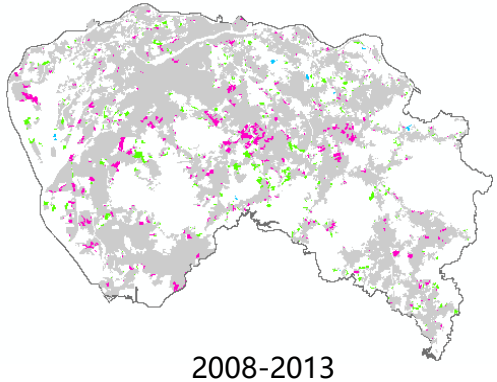
Spreading

Filling

Enclave



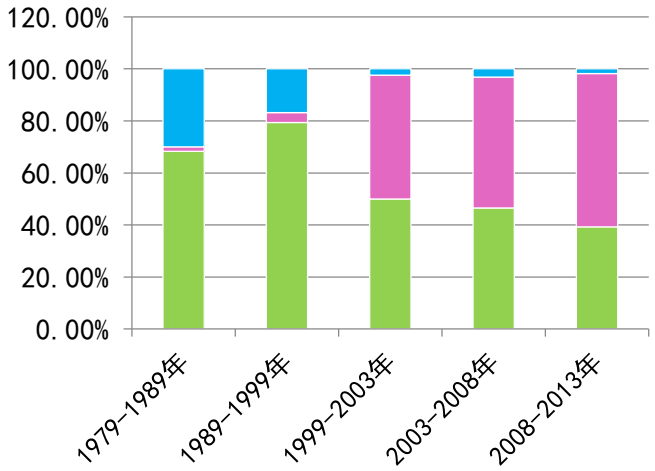
2003-2008



2008-2013

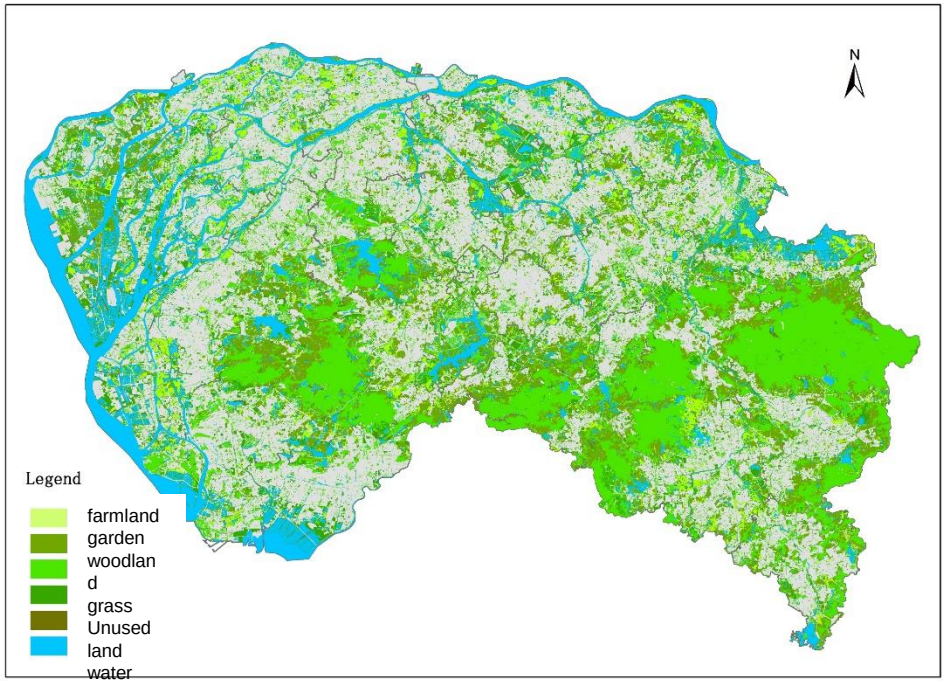
$$S = L/P$$

1979–2013 City expansion mode comparison

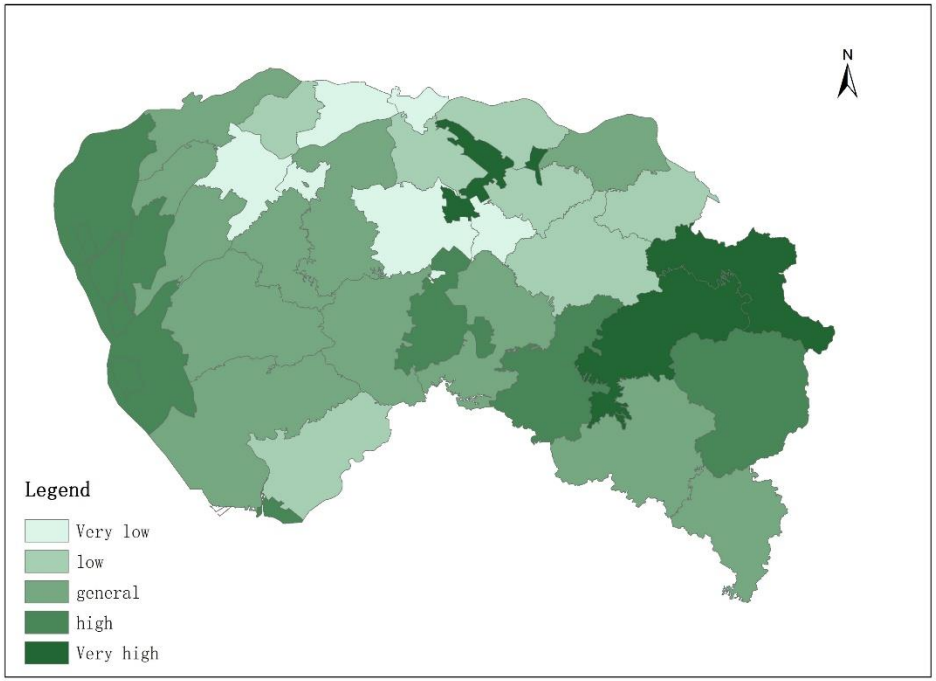


Main mode of urban expansion: spreading and filling

Evaluation of Ecological Land

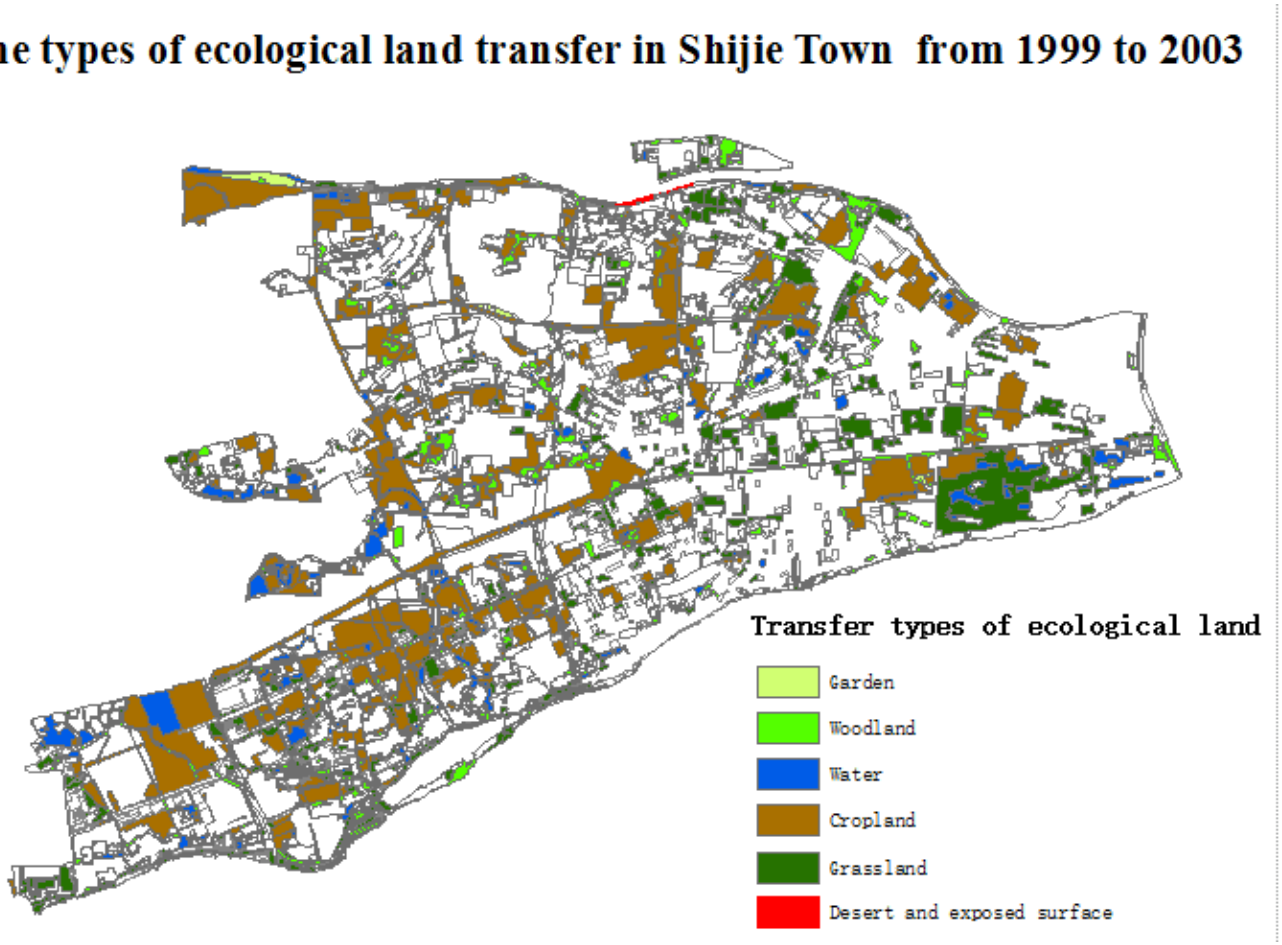


Spatial distribution of ecological land in the City



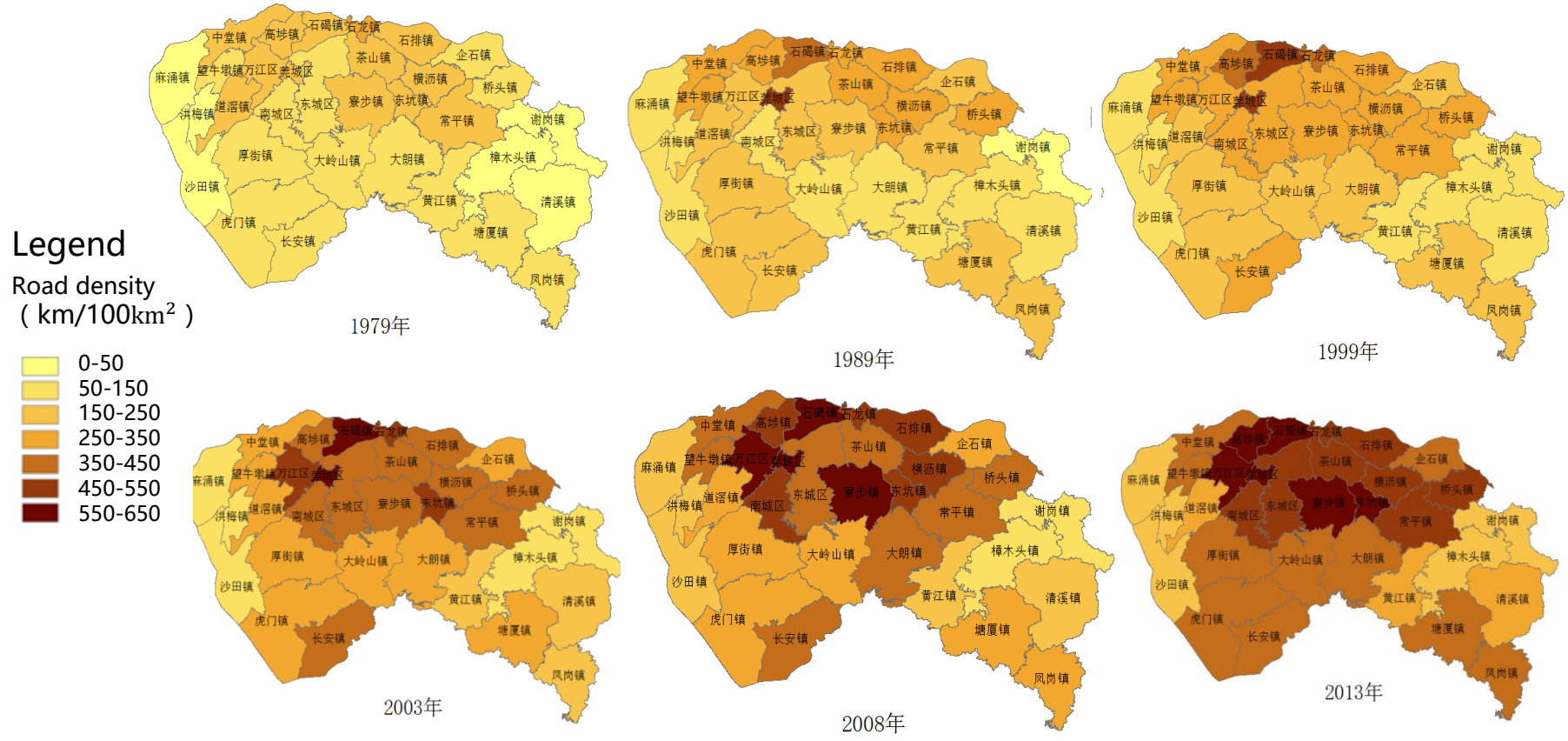
Cover ratio of ecological land in the City

Evaluation of Ecological Land



Spatial distribution of road network

$D_r = Length_r / Area_s$, road network density



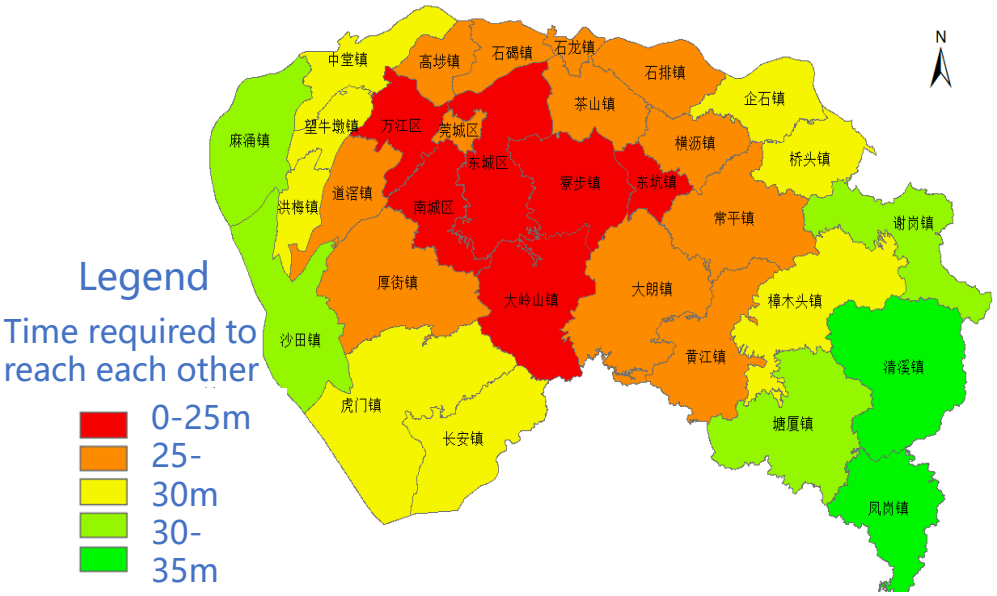
Road network accessibility

Based on space barrier:

$$A_i = \frac{\sum_{i=1}^{n}(T_{ij} * M_j)}{\sum_{j=1}^{n} M_j}$$

T_{ij}:Travel Time from i town to j town

M_j: Weight

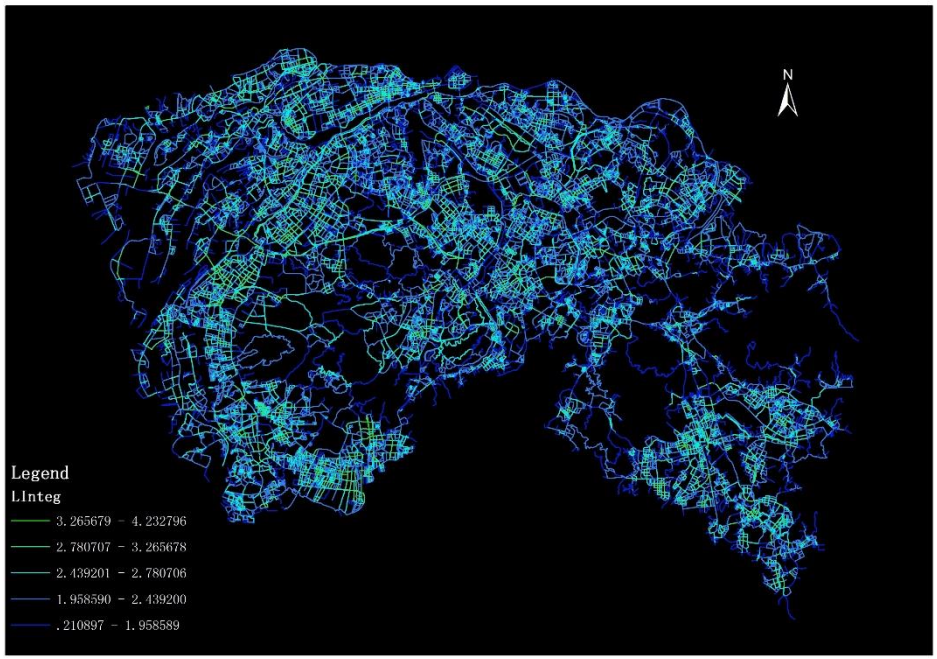


Based on space syntax :

$$L_i = \frac{1}{RRA_i} = \frac{D_k}{RA_i}$$

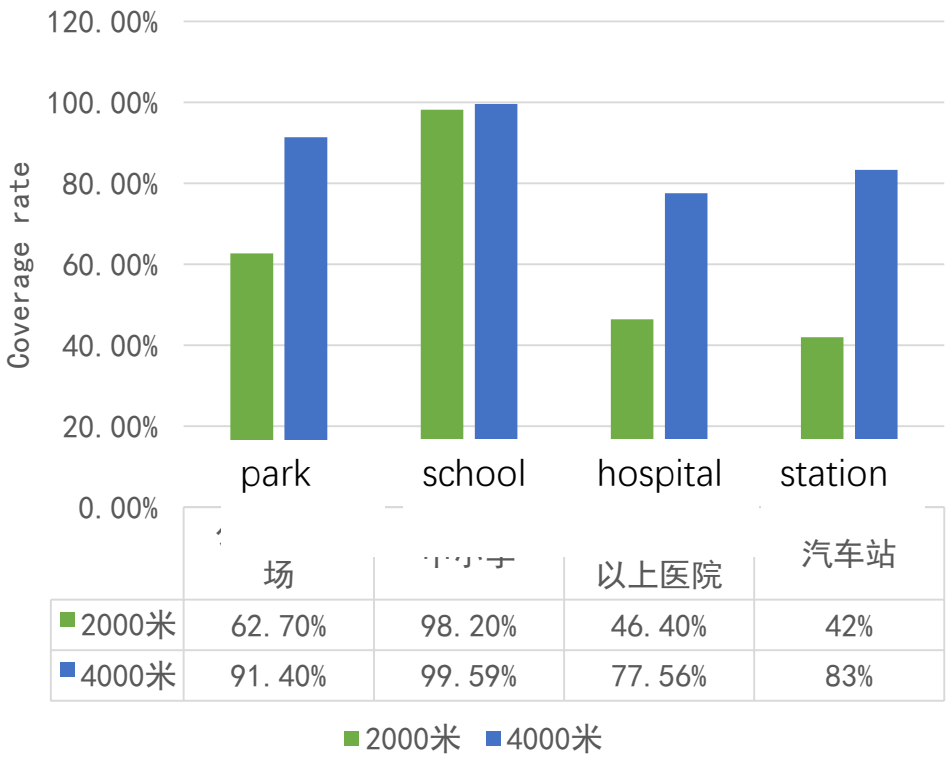
Where:

$$RA_i = \frac{2(P_i - 1)}{n - 2} \qquad D_k = \frac{2n\{log_2^{\left[\frac{n+2}{3}-1\right]} + 1\}}{(n-1)(n-2)}$$



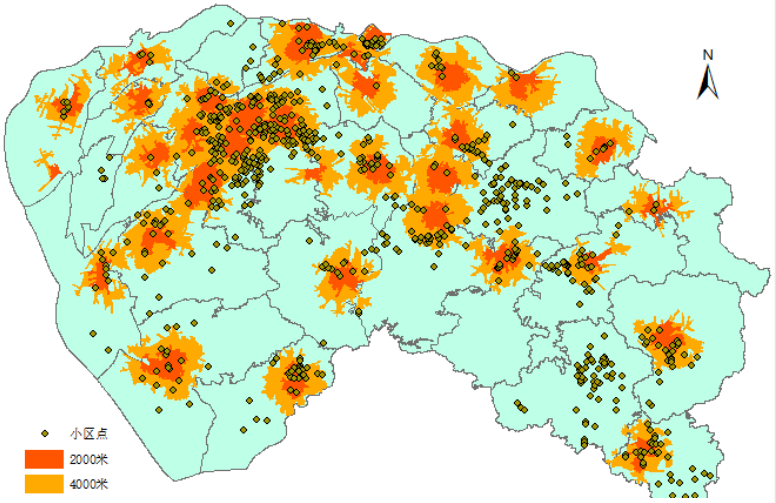
Equalization of infrastructure

Coverage ratio of infrastructure in the City in 2015

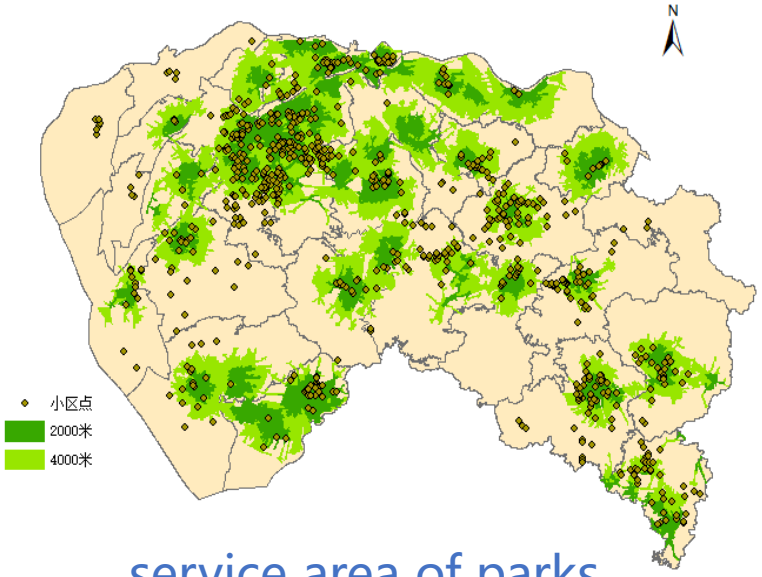


	场		以上医院	汽车站
2000米	62. 70%	98. 20%	46. 40%	42%
4000米	91. 40%	99. 59%	77. 56%	83%

Count the number of residential points in the buffer



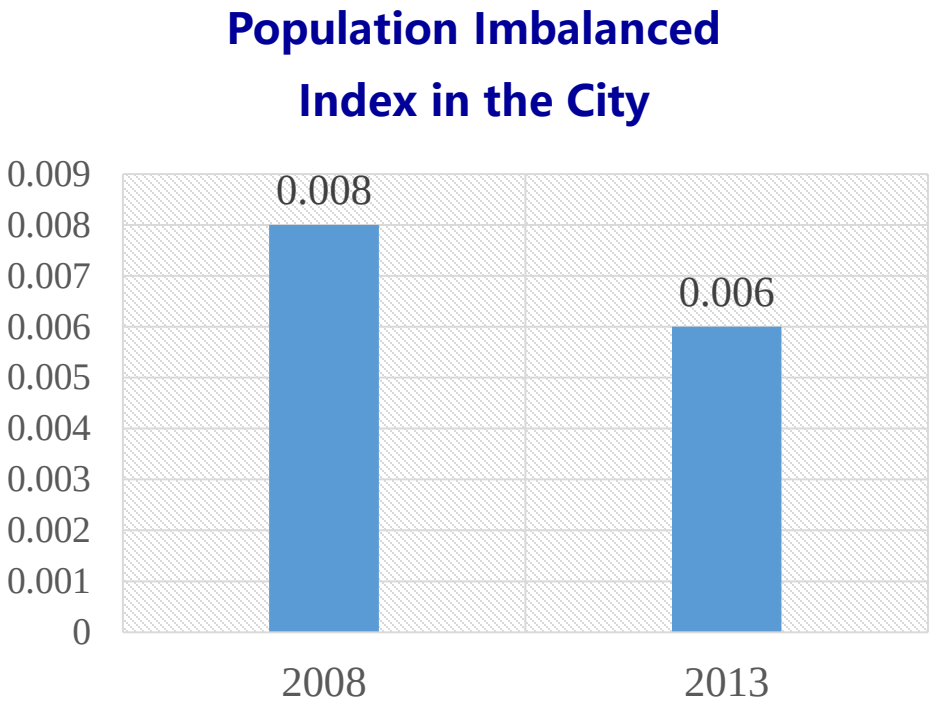
service area of hospitals



service area of parks

Population Imbalanced Indicator

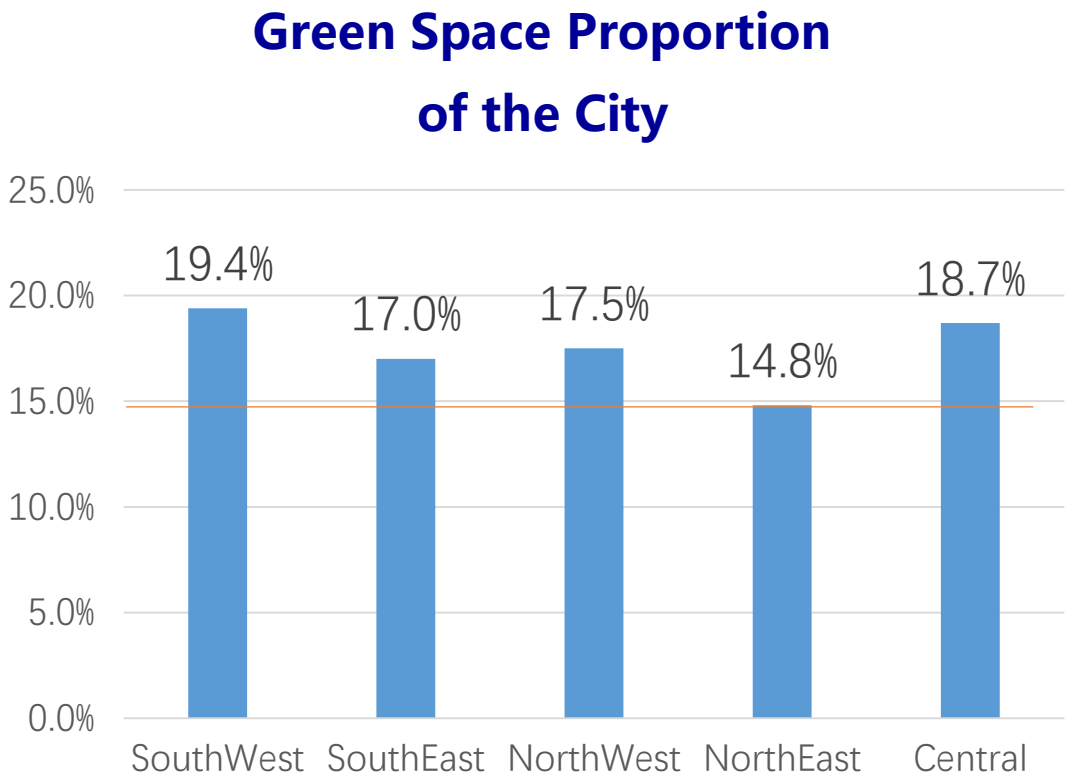
- $U = \sqrt{\frac{\sum_{i=1}^{n}\left[\frac{\sqrt{2}}{2}(x_i - y_i)\right]^2}{n}}$
- Indicator of the imbalanced distribution of urban area and population
- Higher value: more imbalanced



Low level of **Population Imbalanced Index** indicate balanced distribution of urban area and population

Urban Landuse Area and Proportion

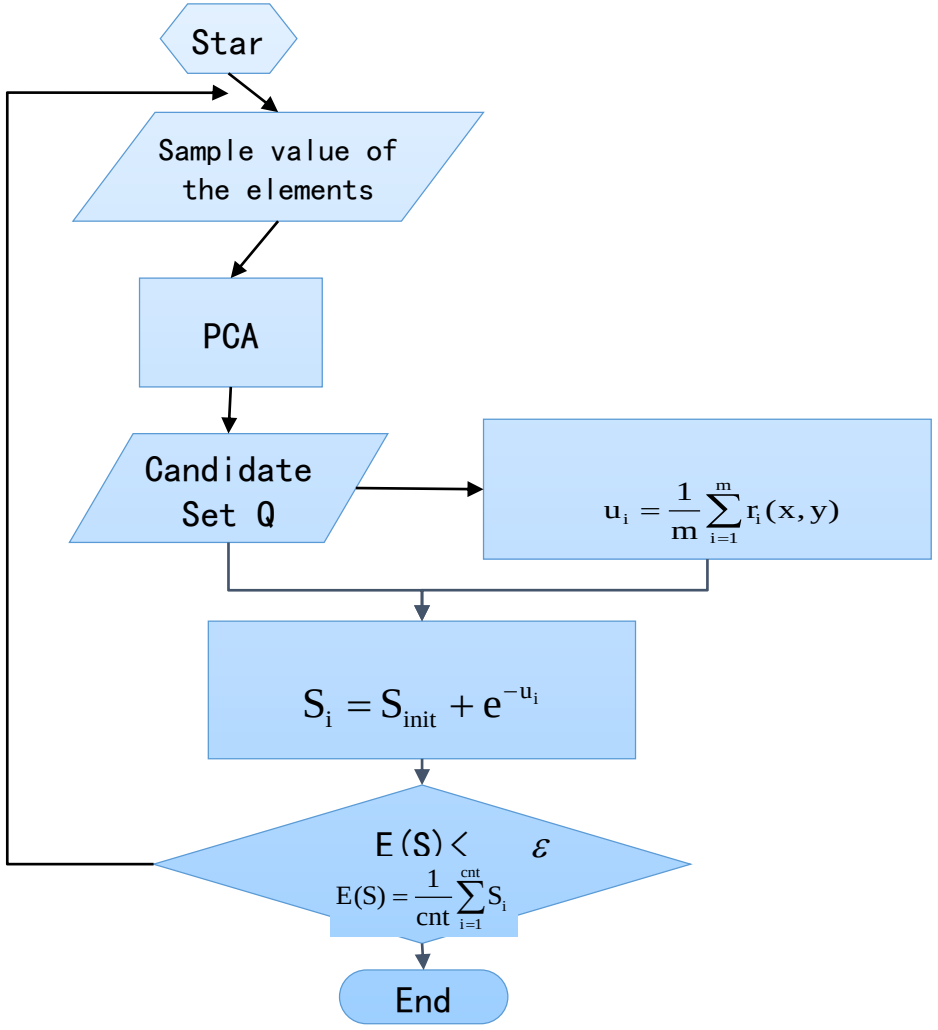
- Urban Landuse Area per capita, Green Space per capita, Green Space Proportion
- Indicator of the reasonability of the urban landuse



High proportion (up to 15%) of **Green Space** indicate good environment in urban area

Index on Geographic Conditions

- Identify components dynamically
- Determine the weight of elements



Contents

Conclusion Remarks

Indicators on urbanization can potentially be used for measure the development of Sustainable Cities and Communities in SDGs.

Gracias !