

Peri-Urbanization in Taiwan :

A challenge for adapting to global environmental change

Shu-Li Huang

National Taipei University/ Graduate Institute of Urban Planning

2008.11.29

International Forum of Global Environmental Change and Land Use Change in Peri-Urban Areas

National Taipei University

Outline

Background / Issue

**Peri-Urbanization in
Taipei- Taoyuan Area**

Land Cover Change

Urban Sprawl

**Evaluation of Ecosystem
Services**

Concluding Remark

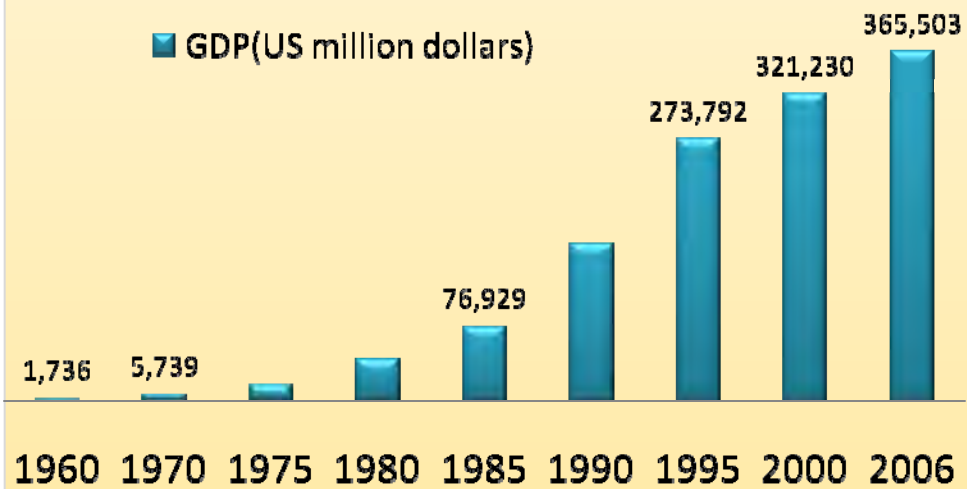
Background / Issue

Global environmental change
vs.
the role of urban area ?



Background / Issue

Taiwan GDP



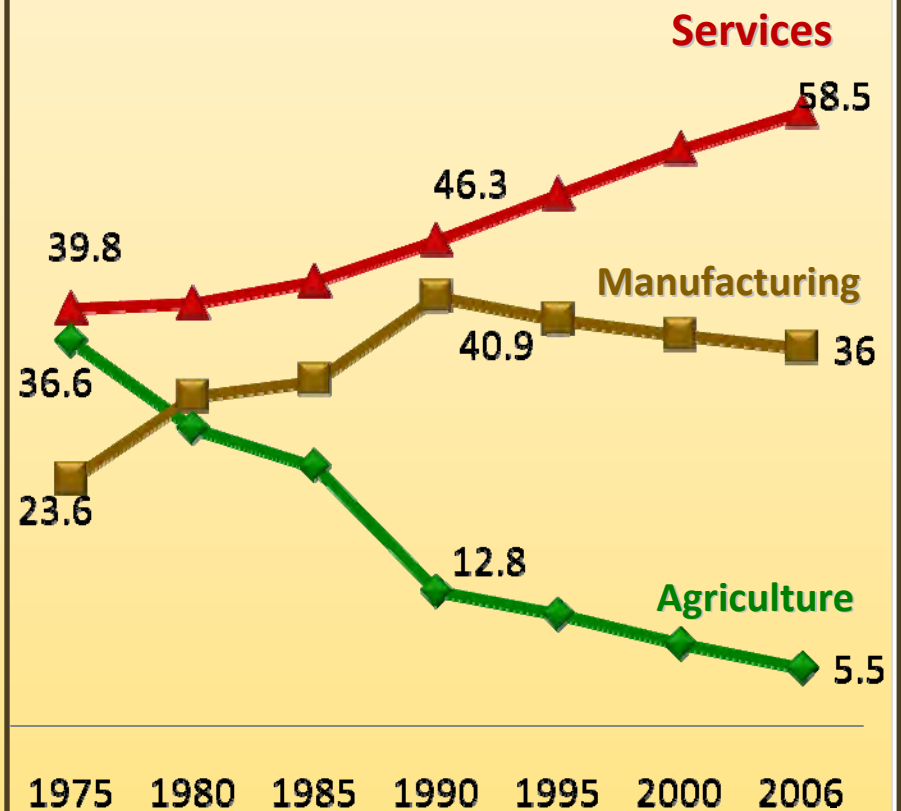
Hsinchu Science Park

<http://www.sipa.gov.tw/,20081120>

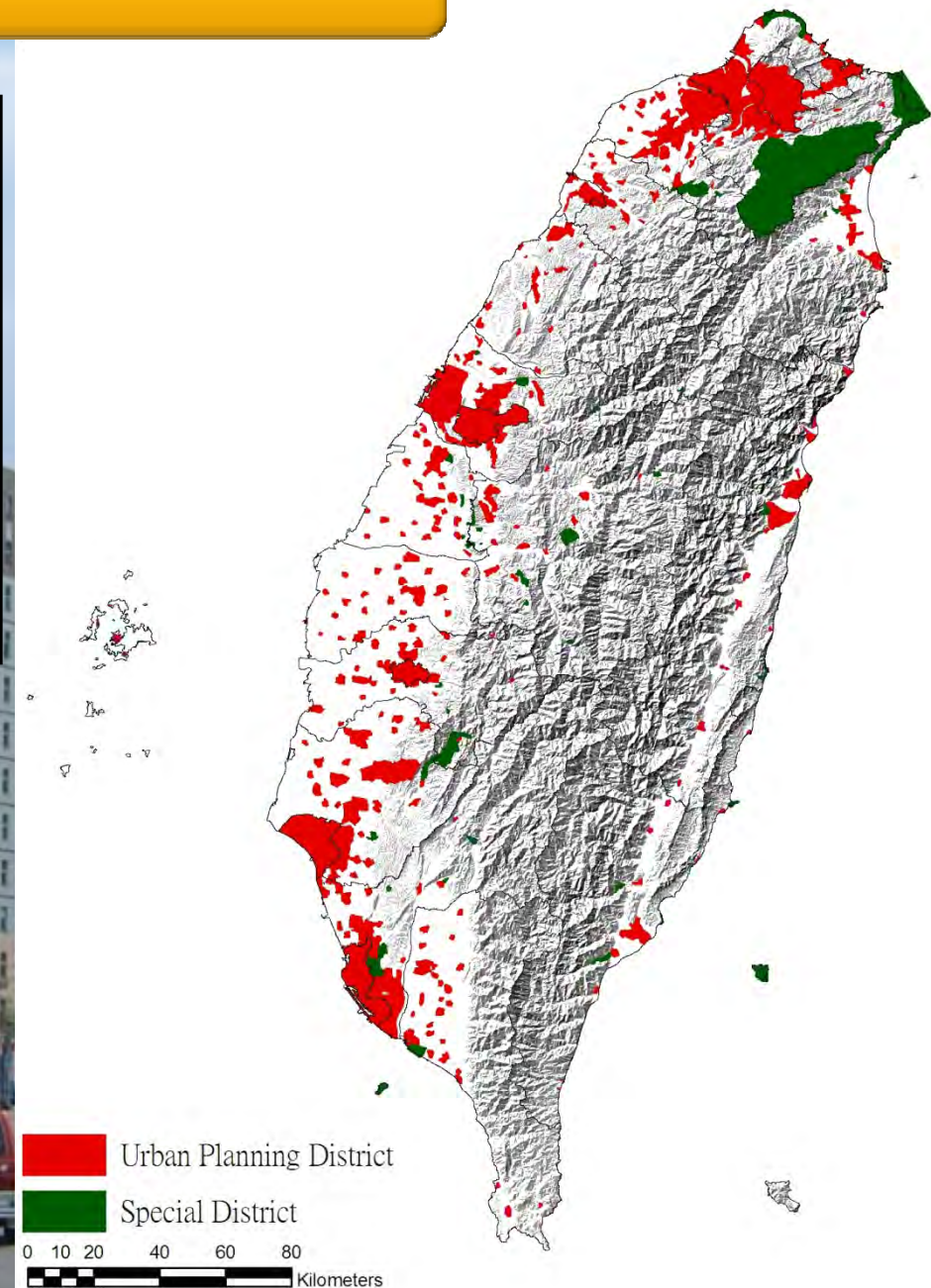
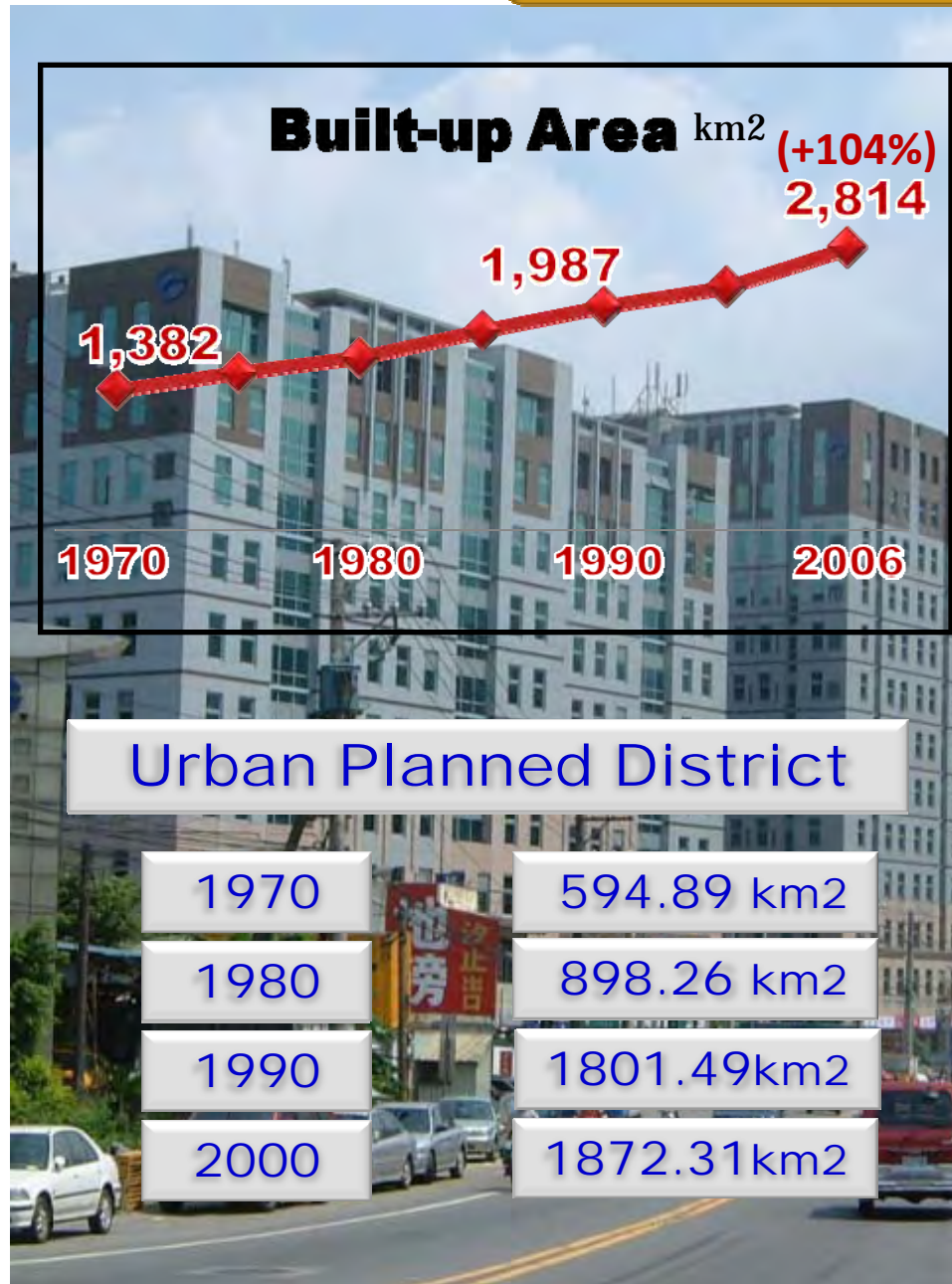


Oil Refinery

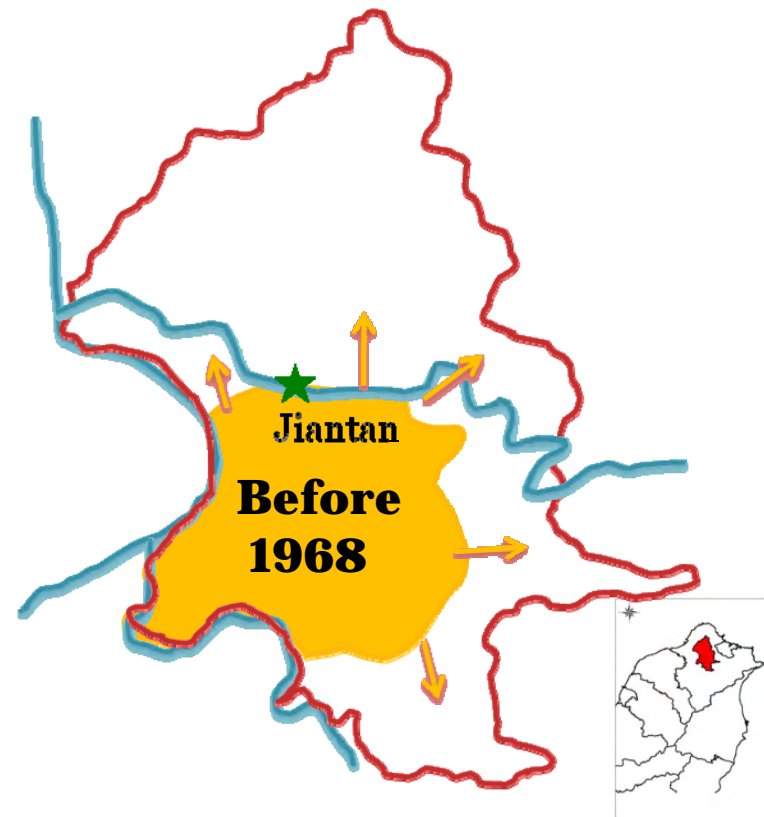
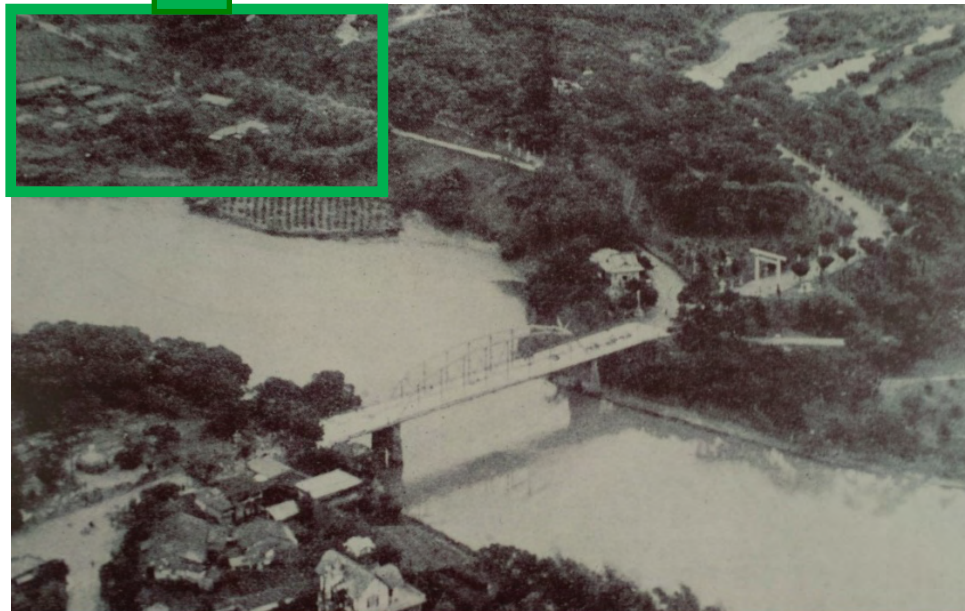
Industrial Distribution of Employed Persons(%)



Background / Issue



Background / Issue



Background / Issue

Taoyuan

1978



2004



Background / Issue

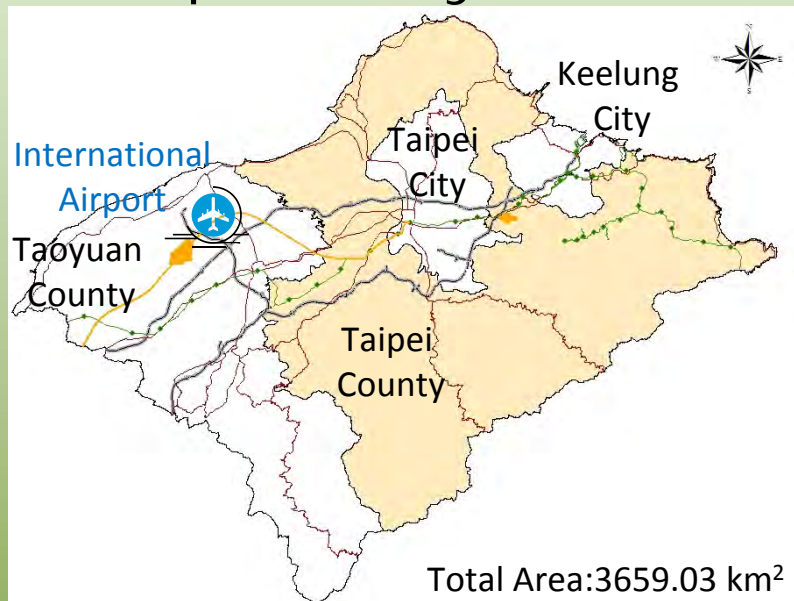


Loss of Ecosystem Service

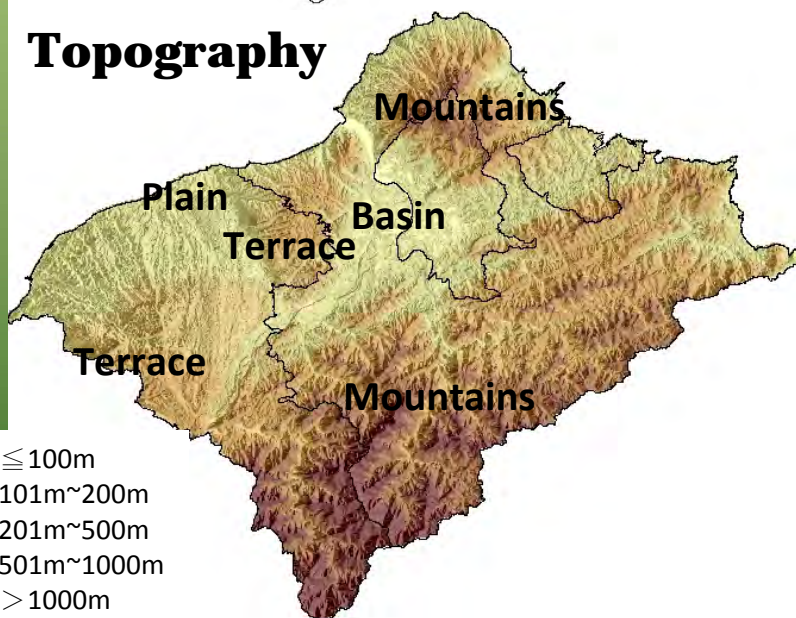
- Agricultural area
 - Water holding capacity
 - Soil formation and nutrient recycling
- ...etc.

Peri-Urbanization in Taipei- Taoyuan Area

□ Taipei-Taoyuan Area

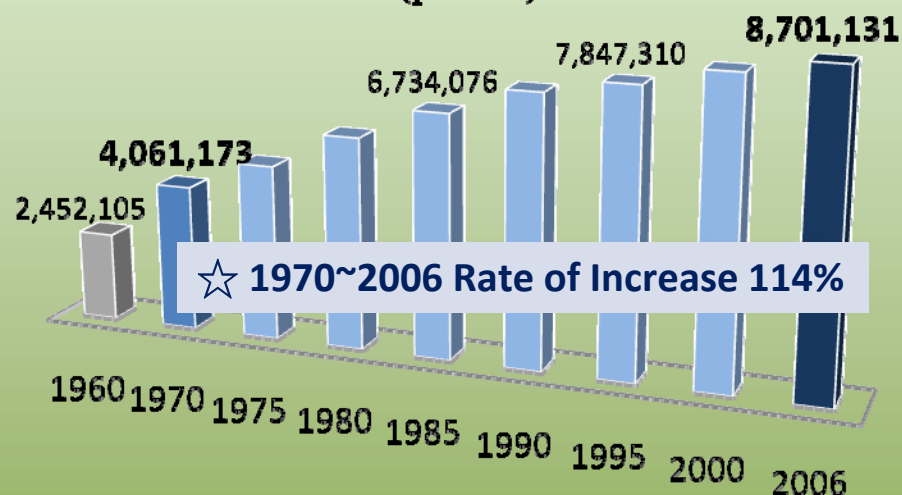


Topography



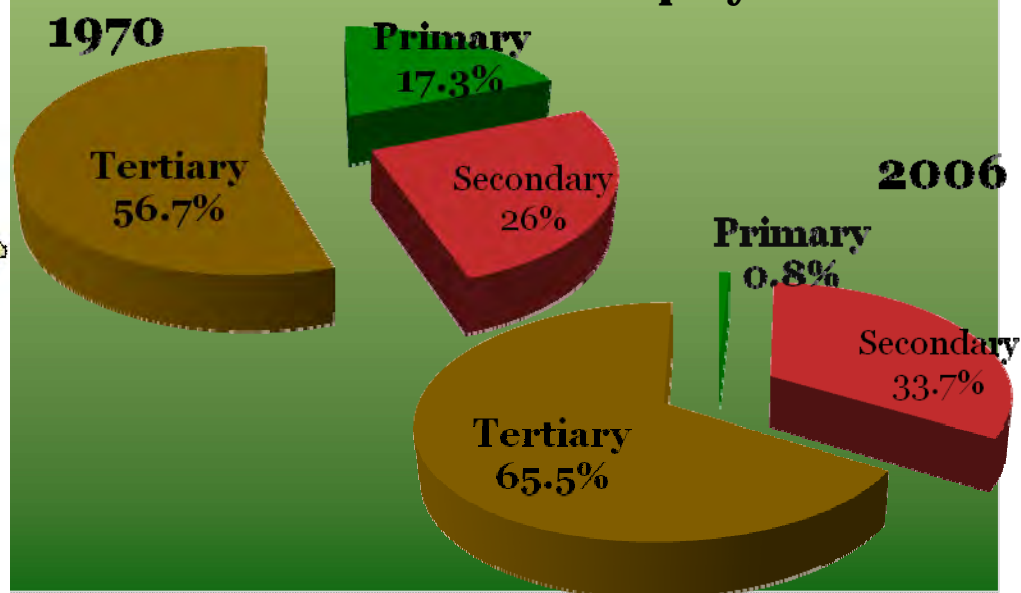
Total Population

(person)



Industrial Distribution of Employed Persons

1970



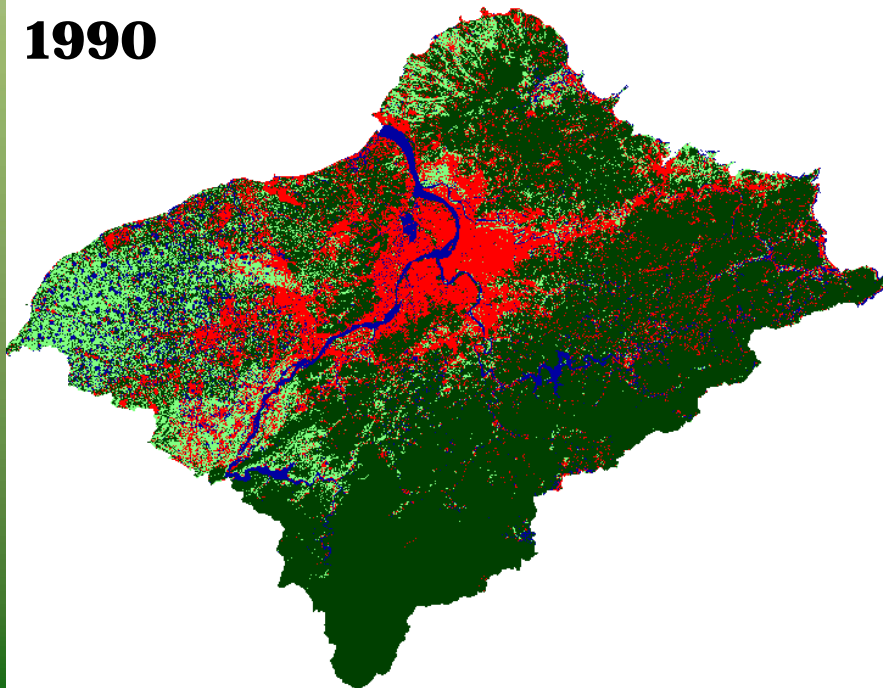
Peri-Urbanization in Taipei- Taoyuan Area

Land Cover Change

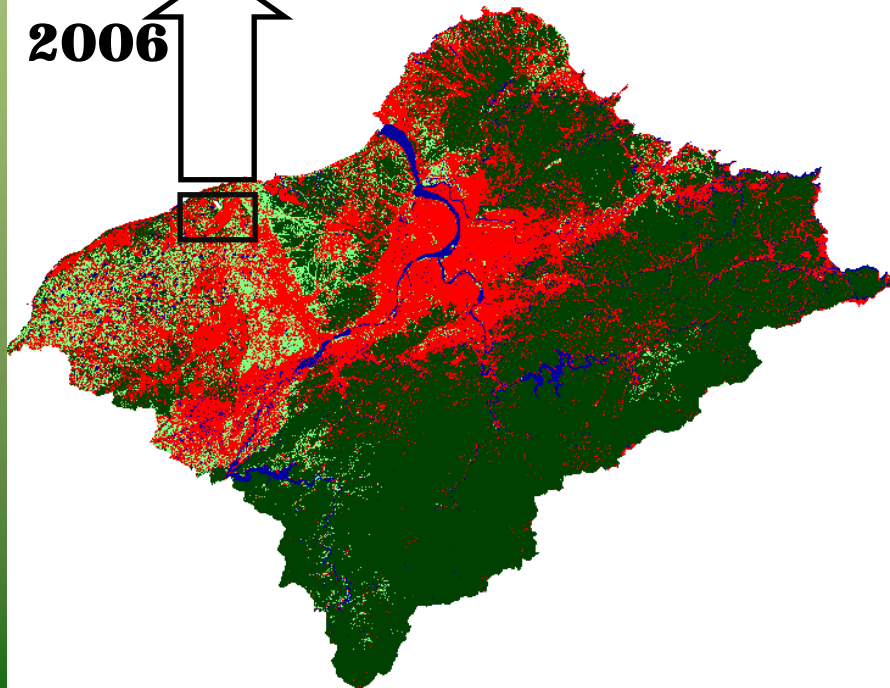
Unit: km²

	1990	2006
forests	2262.06	2124.79
Agricultural/open fields	480.25	319.61
Built-up lands	678.16	1071.43
Water body	238.19	141.56

1990



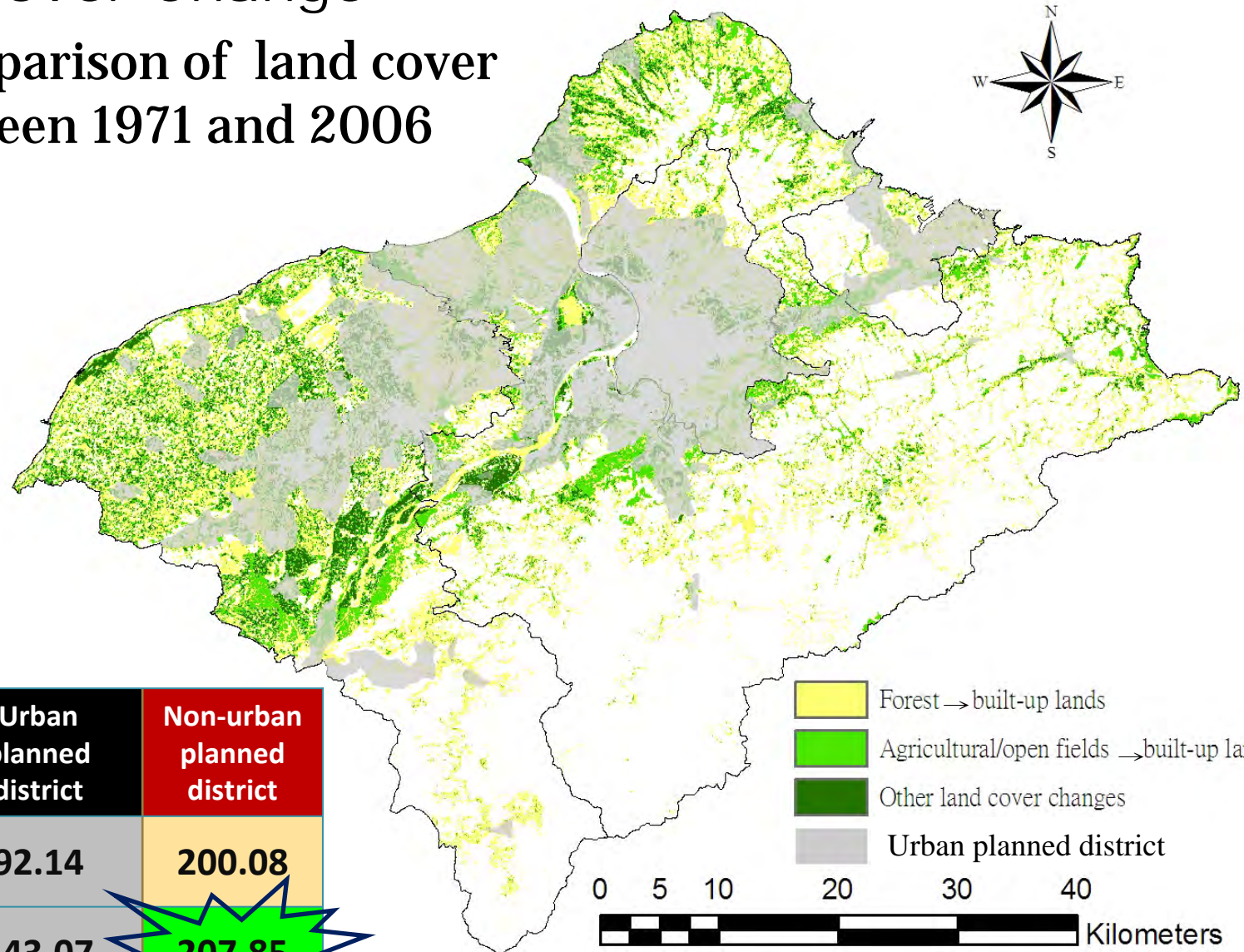
2006



Peri-Urbanization in Taipei- Taoyuan Area

□ Land Cover Change

■ Comparison of land cover between 1971 and 2006



Peri-Urbanization in Taipei- Taoyuan Area

□ Landscape metrics

■ urban area ↑

■ number of urban patch(1971~1990) ↑

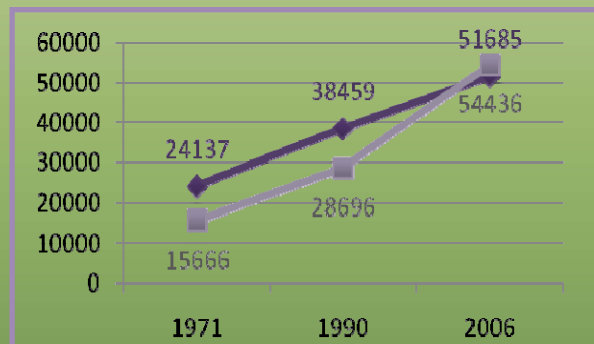
■ mean urban patch area(1971~1990) ↓

■ edge density of urban area ↑

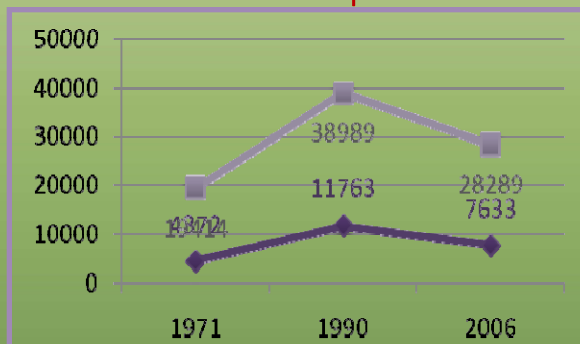
■ Fractal dimension index ↑

■ Urban planned district

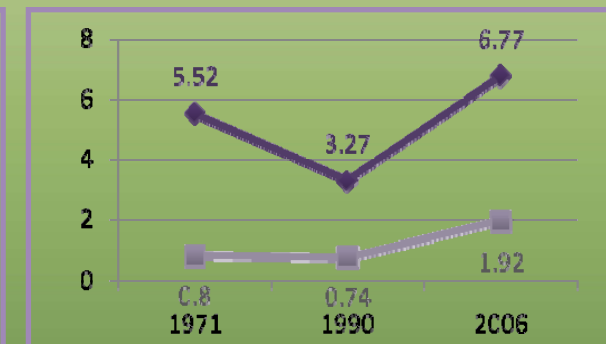
■ Non-urban planned district



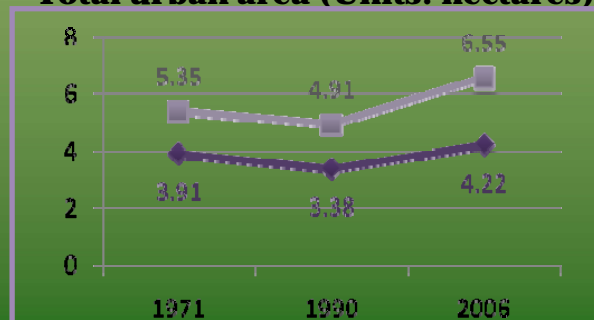
Total urban area (Units: hectares)



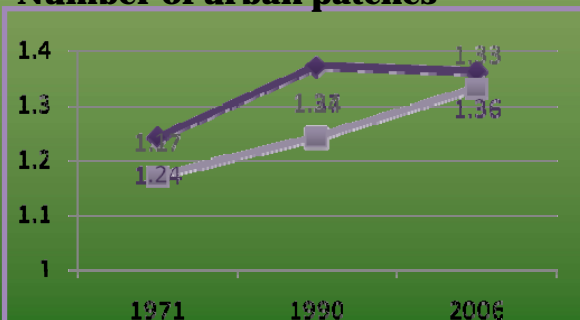
Number of urban patches



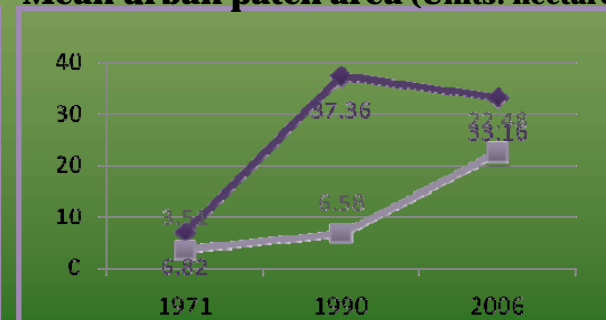
Mean urban patch area (Units: hectares)



**Edge density of urban area
(Units: meters/hectare)**



**Area-weighted mean patch
fractal dimension index**



Area-weighted mean shape index

Peri-Urbanization in Taipei- Taoyuan Area

- **Fragmented built-environment**
- **Irregularity of urban patch**
- **More critical in non-urban planned districts**

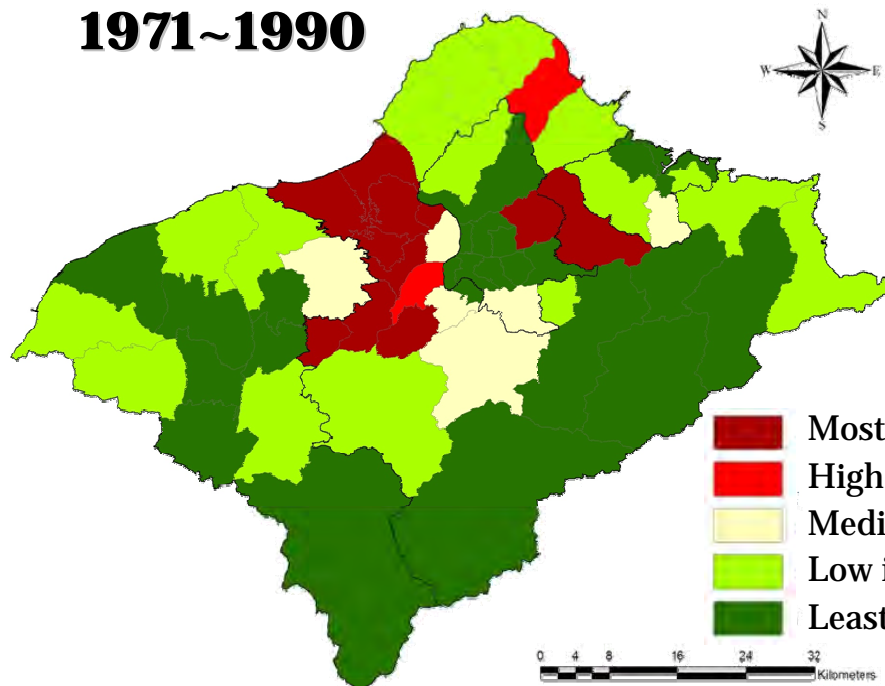


Peri-Urbanization in Taipei- Taoyuan Area

Land cover, Economic productivity, Population

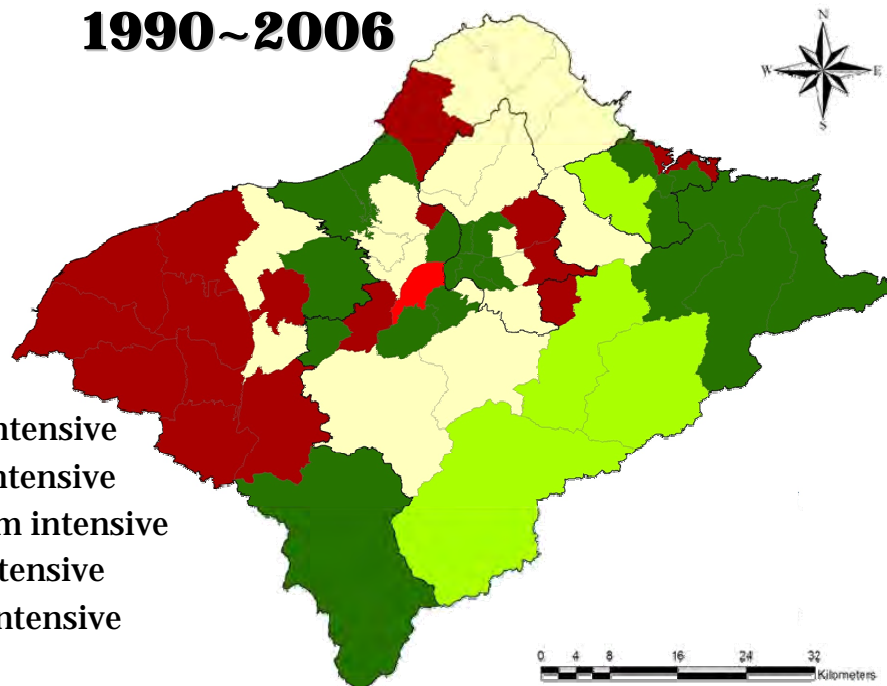
Urban Sprawl

1971~1990



\propto increase of economic productivity

1990~2006



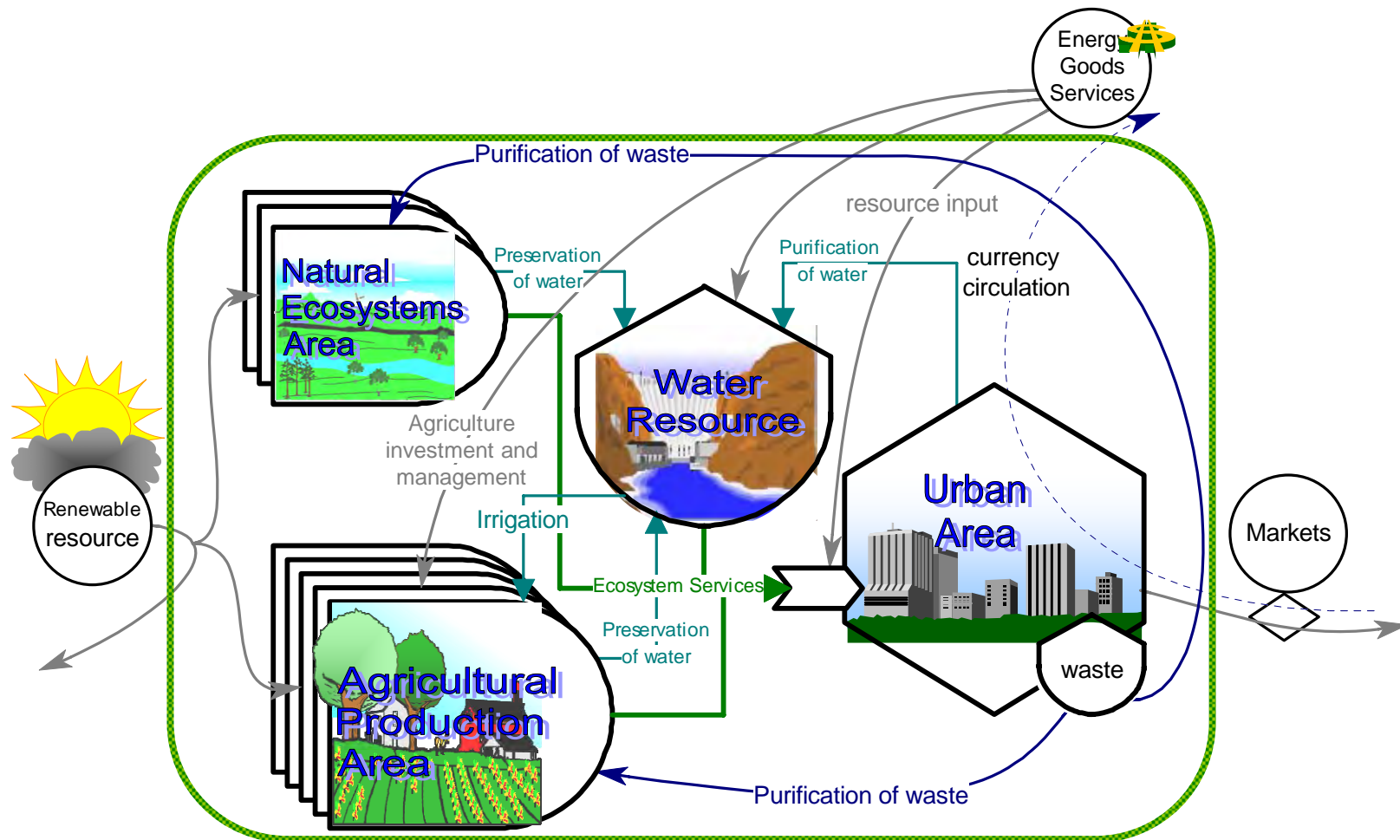
\propto location of urban planned districts

Evaluation of Ecosystem Services

- Emergy synthesis to include both human and nature for evaluating the work of nature.
 - **value : the environmental work supporting a product or service.**
 - **energy mass → solar emergy**
- Impact Matrix to identify systemic roles of ecosystem components.
 - **influence between system components**
 - **(active vs. passive) , (critical vs. indifferent)**

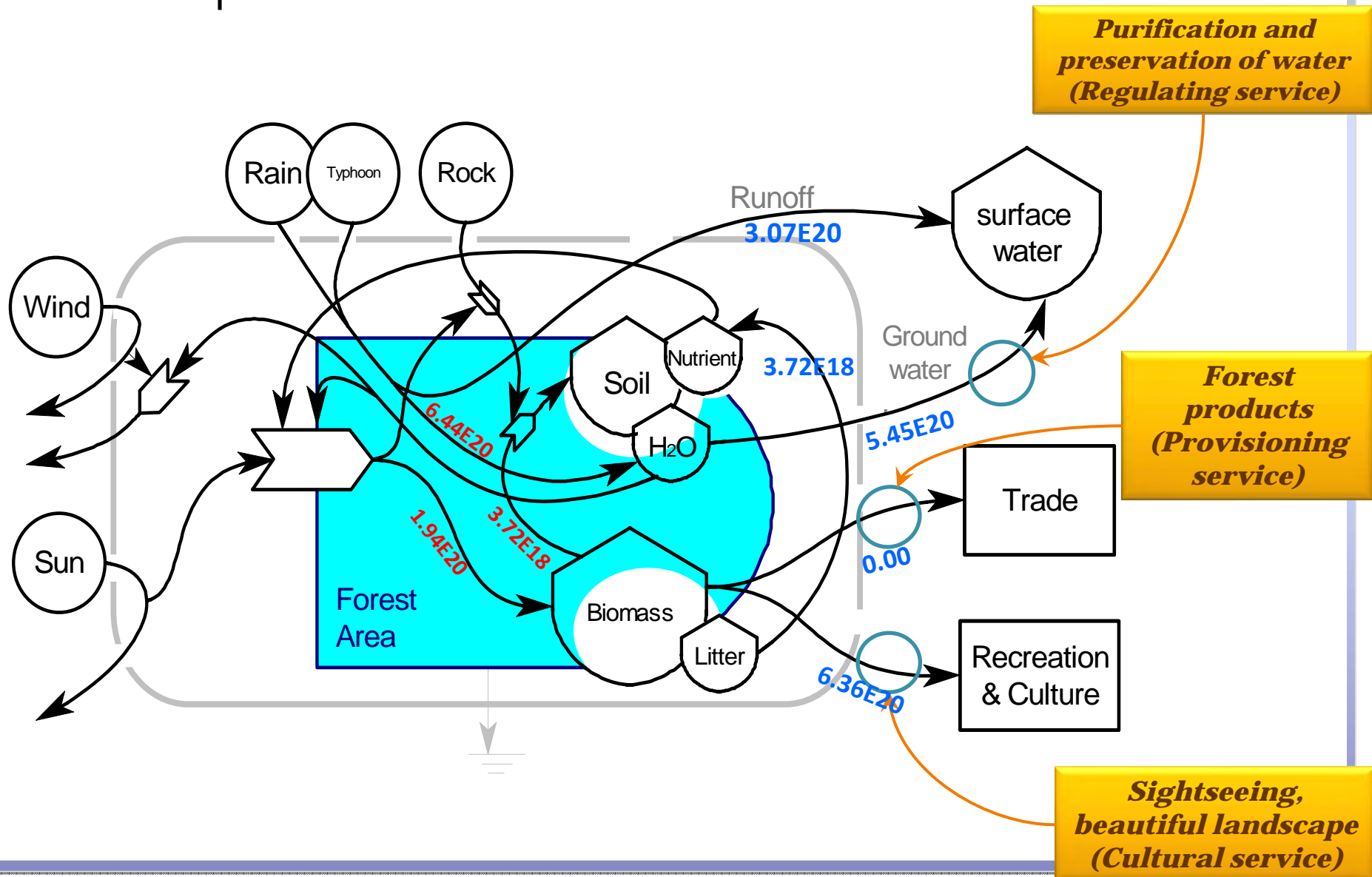
Evaluation of Ecosystem Services

Urban ecosystem – Taipei-Taoyuan Area



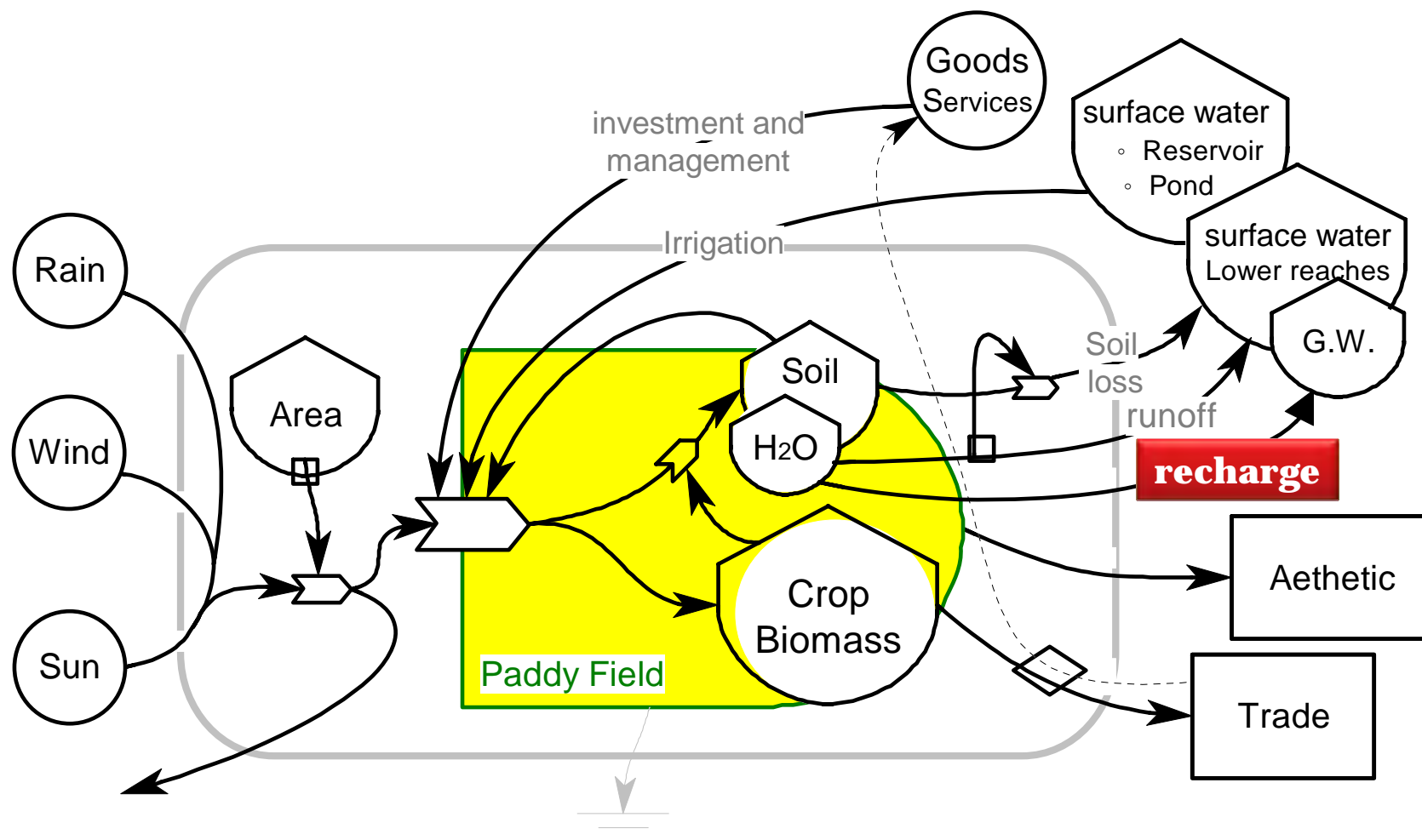
Evaluation of Ecosystem Services

Example : Forest



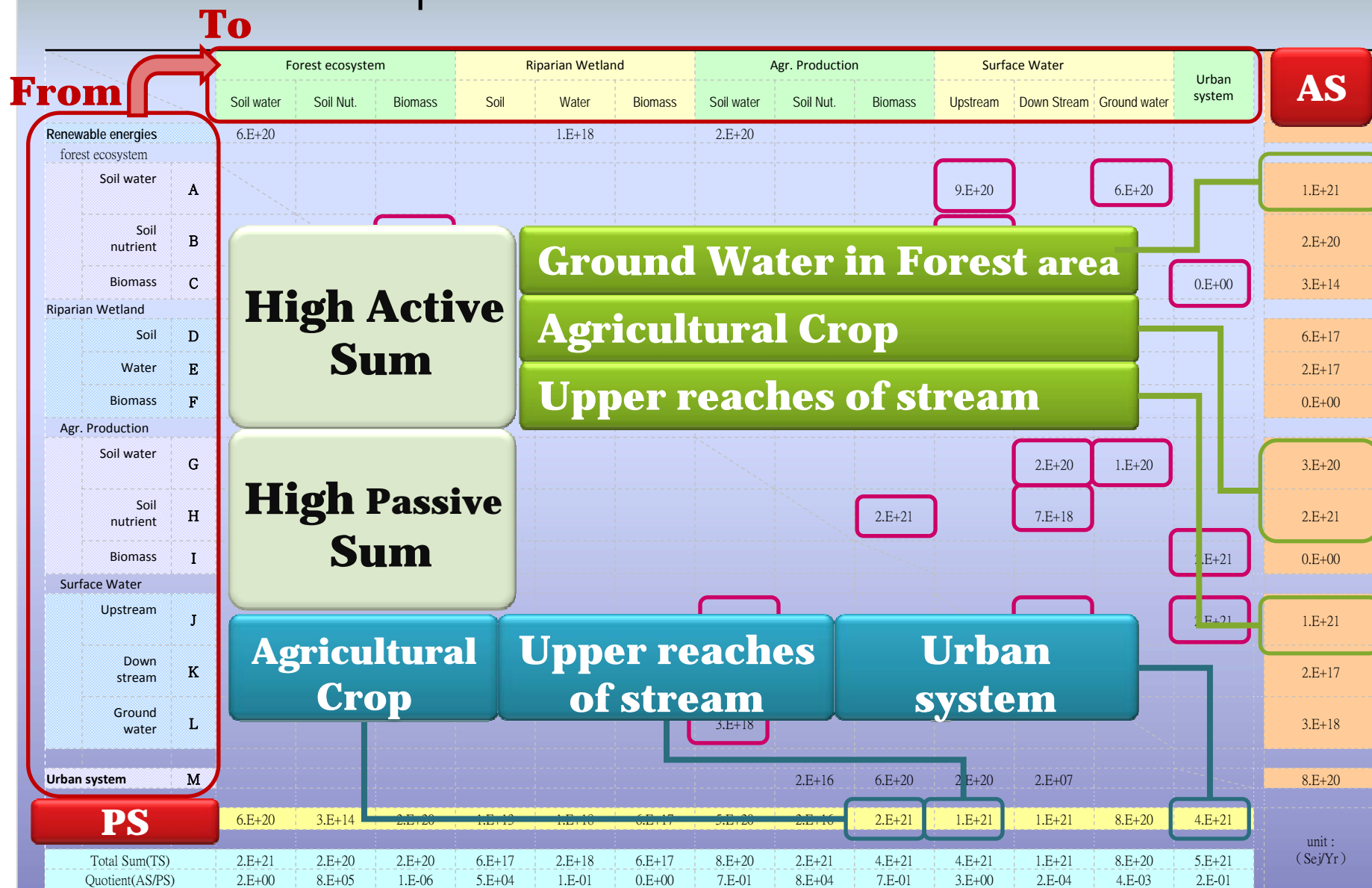
Evaluation of Ecosystem Services

Example : Paddy Rice Field



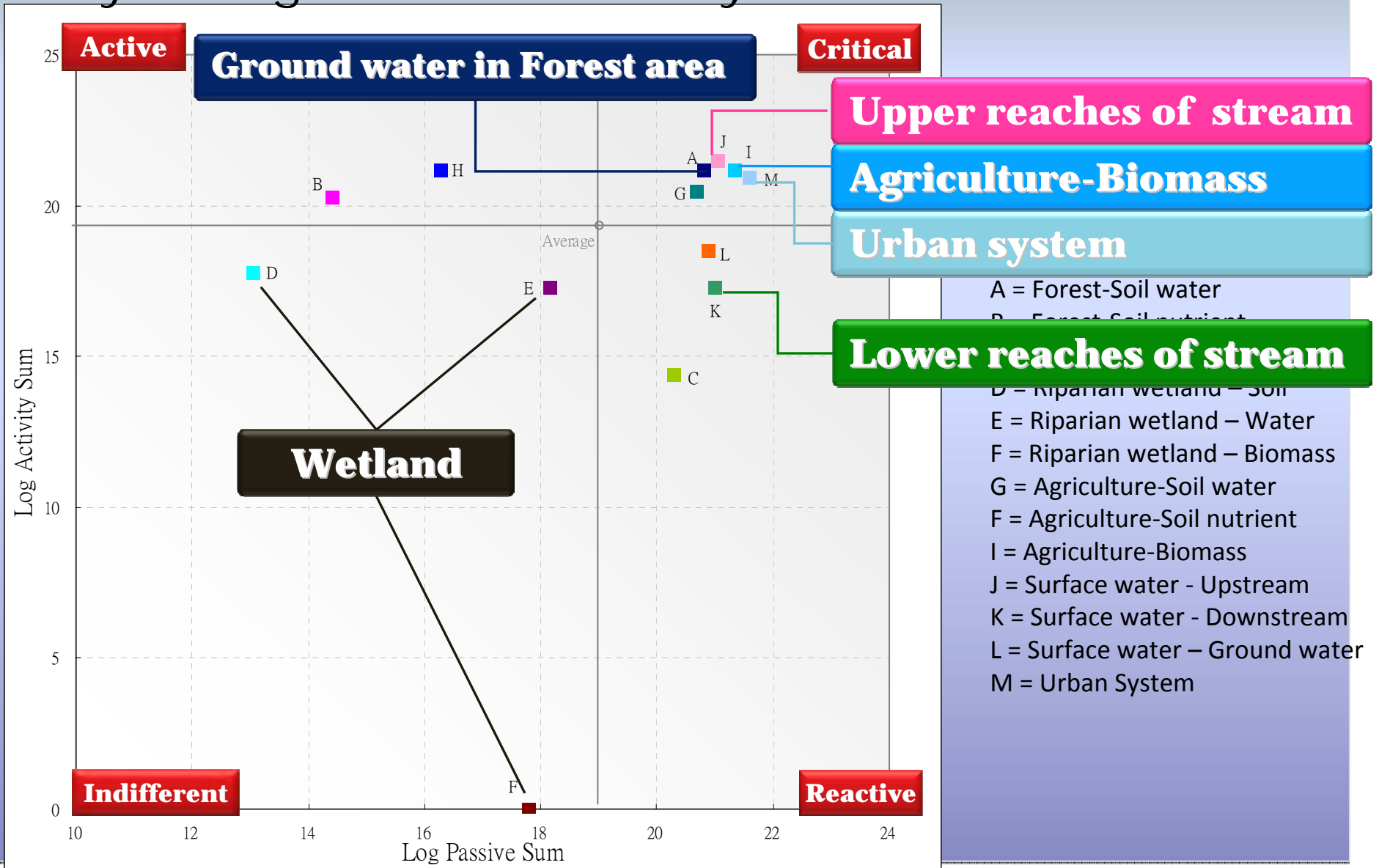
Evaluation of Ecosystem Services

Result of Impact Matrix



Evaluation of Ecosystem Services

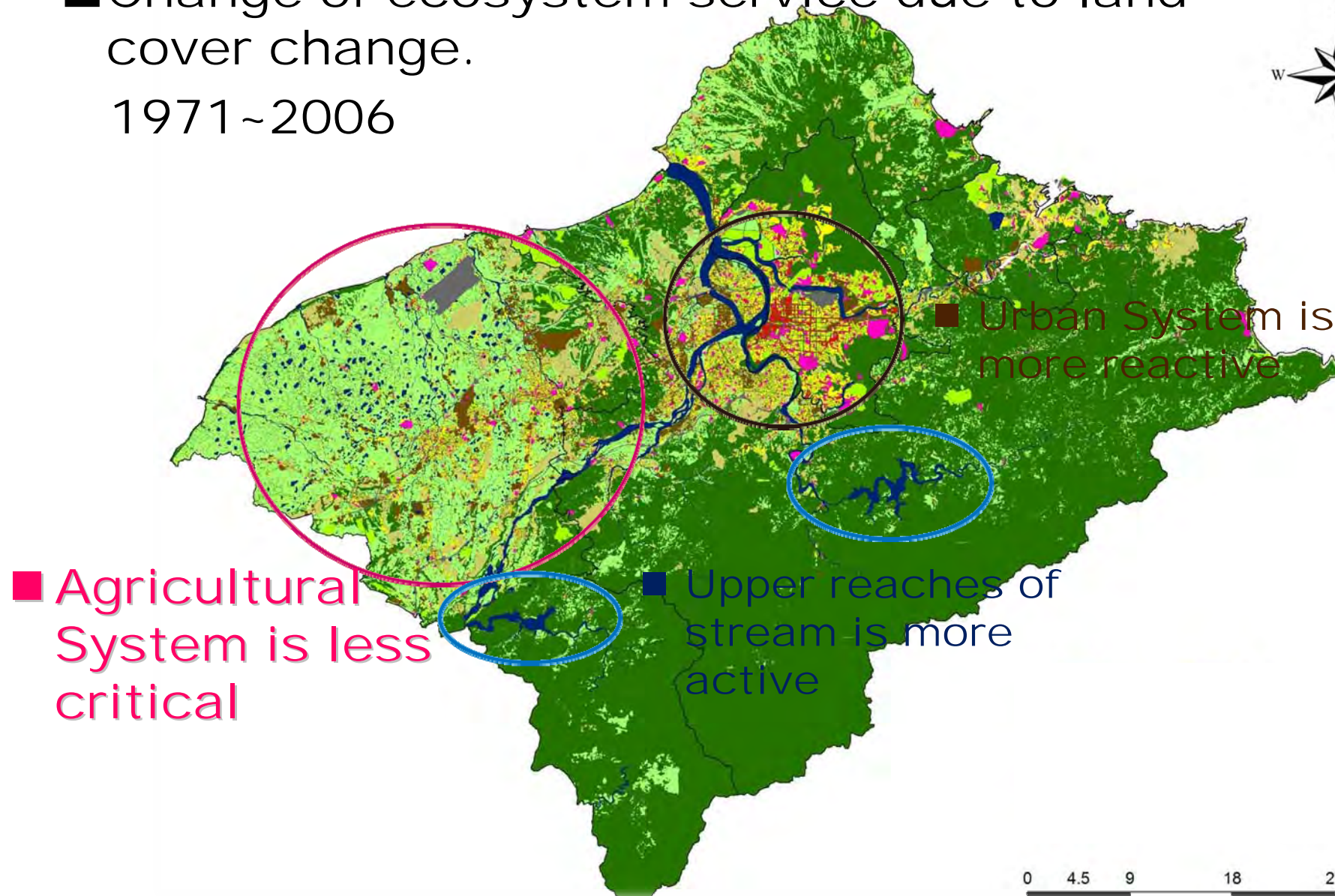
□ System grid with summary of results



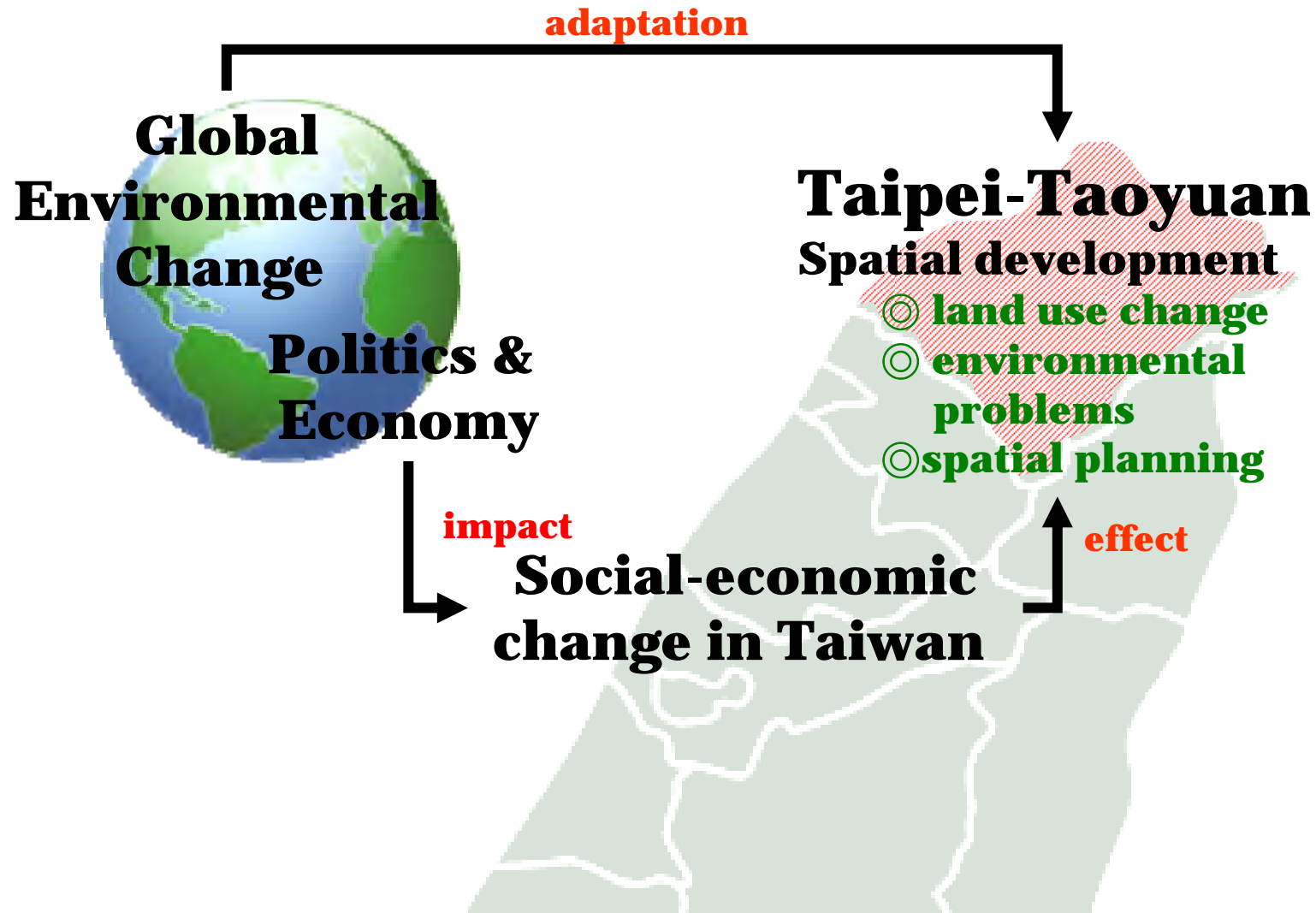
Evaluation of Ecosystem Services

- Change of ecosystem service due to land cover change.

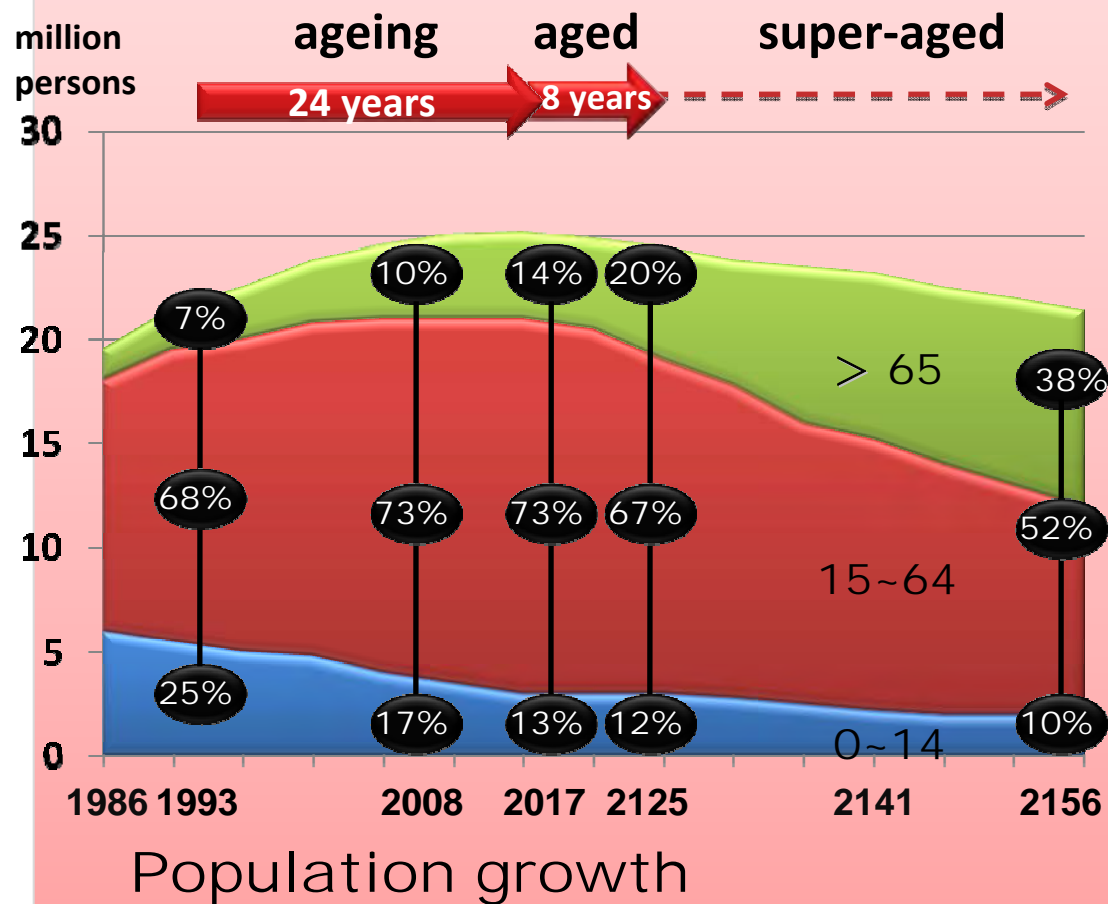
1971~2006



Concluding Remark



Concluding Remark



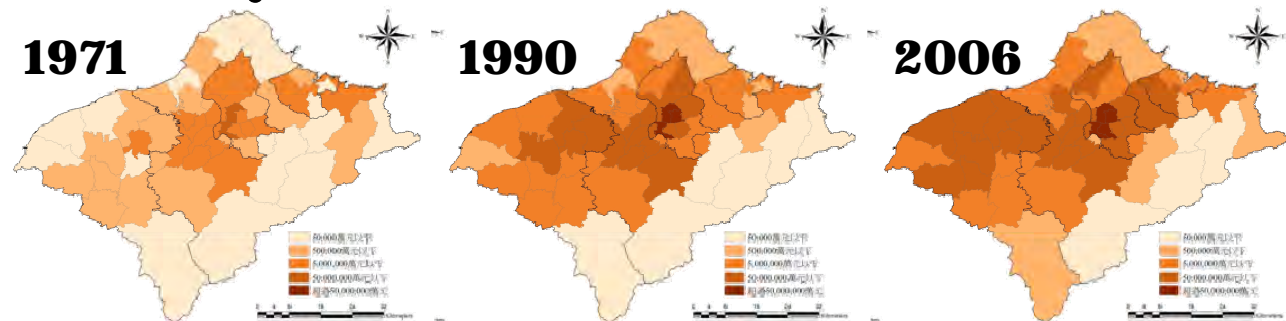
Thanks for Your Attention



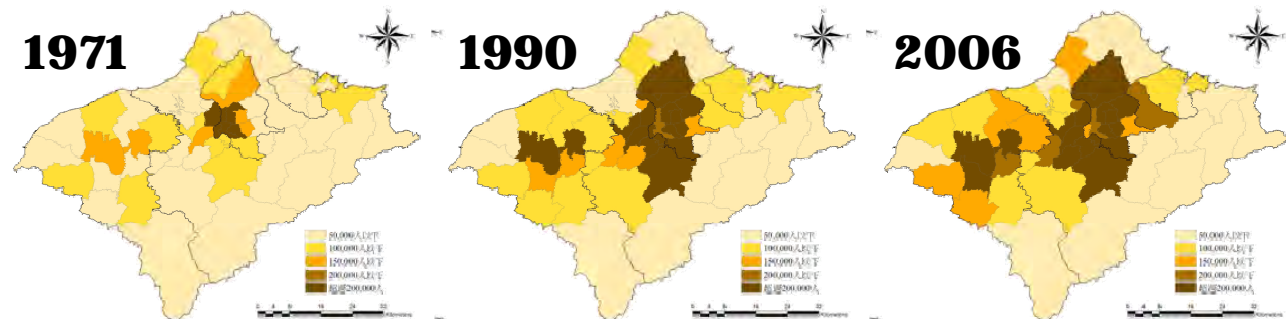
Peri-Urbanization in Taipei- Taoyuan Area

Urban Sprawl

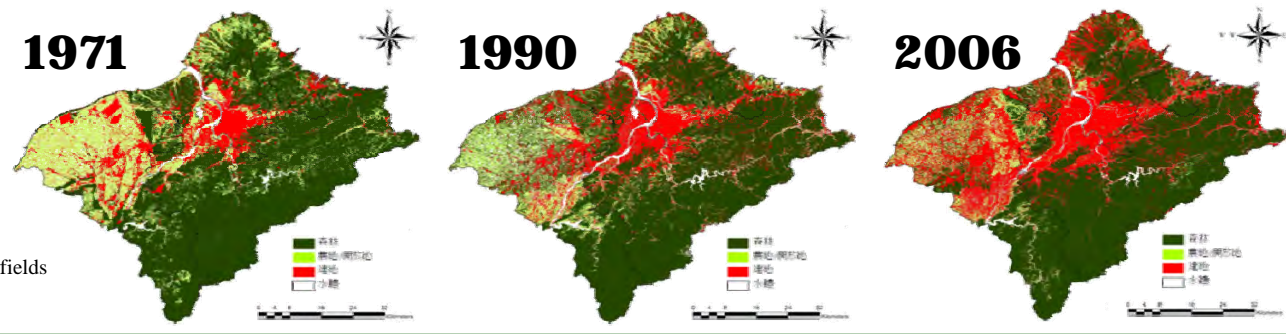
Economic productivity



Population



Land cover



Evaluation of Ecosystem Services

□ Ecosystem vs. Services

<div> <div>Ecosystem</div> <div>Services</div> </div>	Natural Ecosystem Area		Agricultural Production Area						Surface water	
	Forest	Riparian wetland	Paddy rice field	Crop land	Orchard	Range lands	Fallow	Agriculture	Upstream	Downstream
Provisioning Services										
Food			●	●	●	●		●		
Fresh water	●								●	
Regulating Services										
Water regulation	●	●	●	●						
Erosion regulation	●			●	●					
Water purification and waste treatment		●								●
Cultural Services										
Aesthetic values	●		●	●	●	●	●	●	●	●
Recreation and ecotourism	●	●		●	●	●		●	●	●
Supporting Services										
Soil Formation	●						●			
Primary production	●		●	●	●					
Nutrient cycling	●	●		●			●			