# Study on Carbon Budget for Ecosystems of China: Aspects and Progress

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# SCIENTIFIC THEMES FOR CHINESE SCIENTISTS

1. How do C sources and sinks vary over time for different ecosystems?
2. How do patterns of C sources and sinks distribute regionally?
3. Key factors driving the processes of C cycling in different ecosystems?

# SCIENTIFIC THEMES FOR CHINESE SCIENTISTS

4. **Responses of different ecosystems to the global change?**

5. **Options that can enhance the C storage and/or reduce the C emissions from different ecosystems?**

# Projects

- **Study on Carbon Budget in Terrestrial and Marginal Sea Ecosystems of China, CBTSEC launched by the Chinese Academy of Sciences (2001~2005)**

- **Carbon Cycle and Driving Mechanisms in China Terrestrial Ecosystems, CCDMCTE supported by the Ministry of Science and Technology of China (2003~2007)**

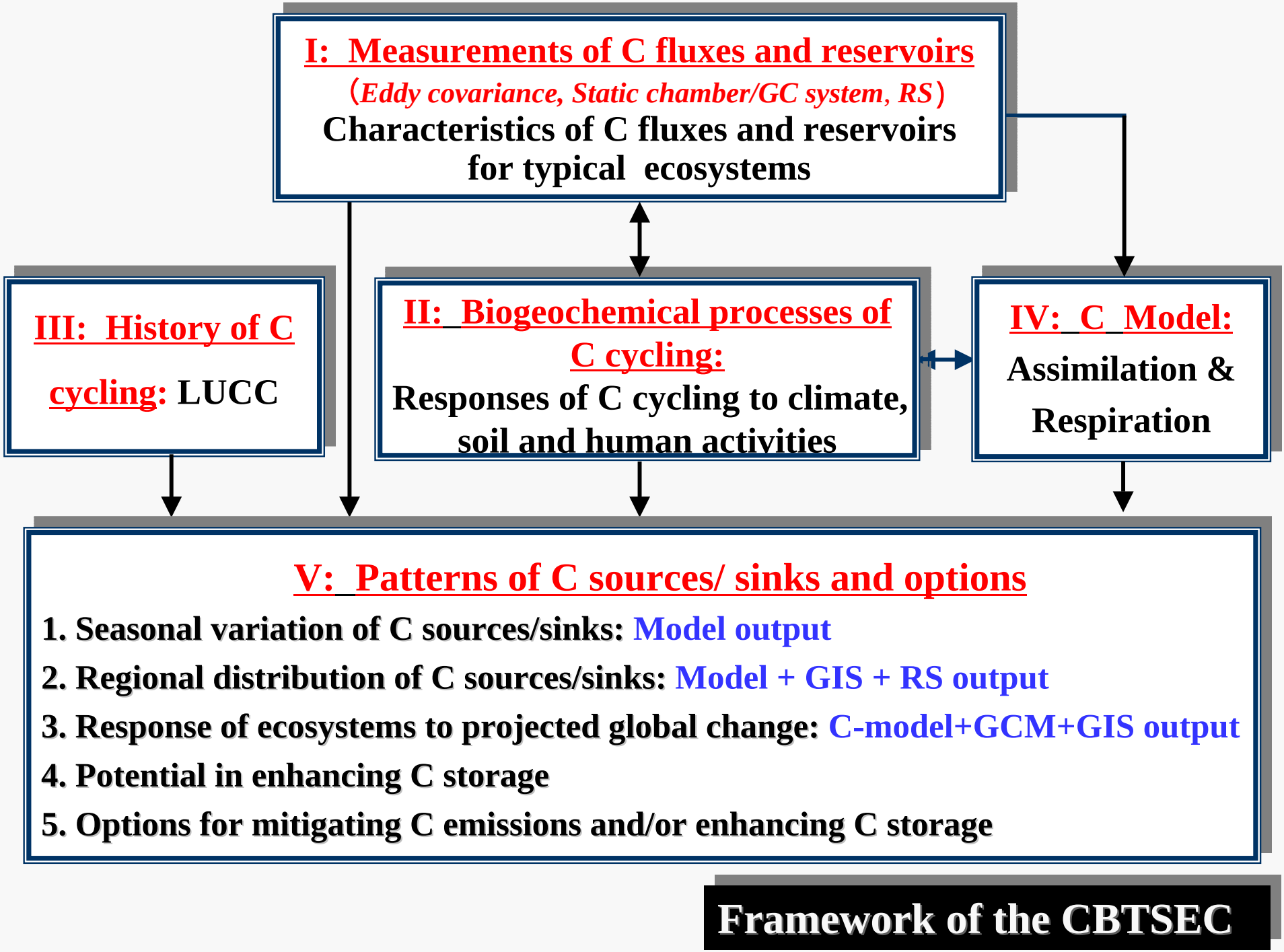
# Objectives of the CBTSEC

1. To clarify the characteristics of C fluxes and reservoirs for different ecosystems

2. To address the role of climate, soil and human actions playing in the terrestrial C cycling processes

3. **To compile an inventory of current C budget regarding to the terrestrial ecosystems of China**
4. **To evaluate the potential response of ecosystems to projected global change**

5. **To assess the contribution of land-use and land-cover change (LUCC) to C sink/source relationship during the last 100-year period**
6. **To develop techniques that can enhance the C storage and/or reduce C emissions**




Framework of the CBTSEC

# Topics and Progress of the CBTSEC

**1 Carbon fluxes and reservoirs in typical Chinese terrestrial and marginal sea ecosystems**

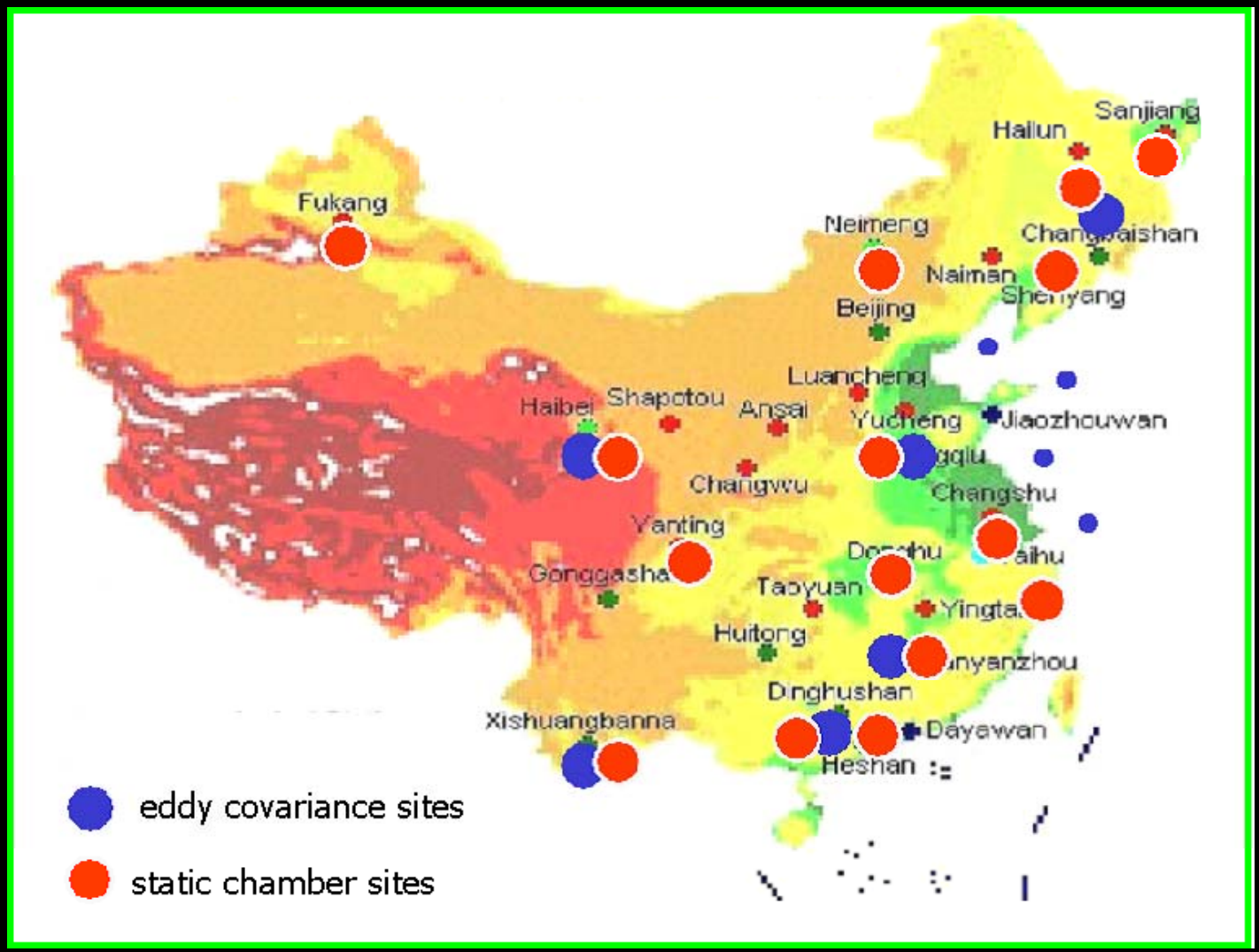
**Key aspects:**

**Observations and measurements *in situ***

- ✓ ***Eddy covariance***
- ✓ ***Static chamber/GC system***
- ✓ ***Remote sensing***

# Establishment of ChinaFlux network

## *Eddy covariance, Static Chamber/GC, Remote Sensing*




forest


grass

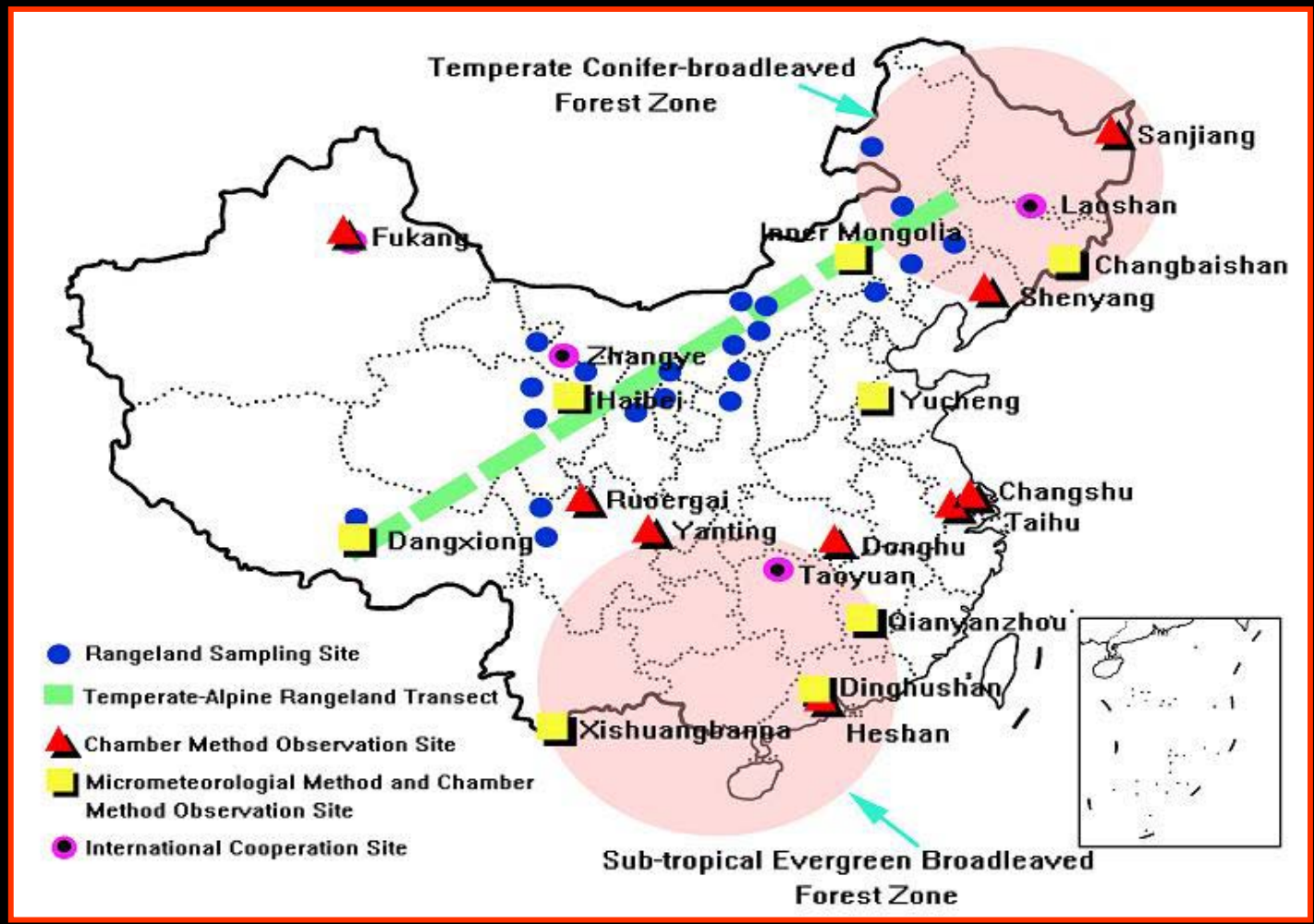

agriculture


wetland

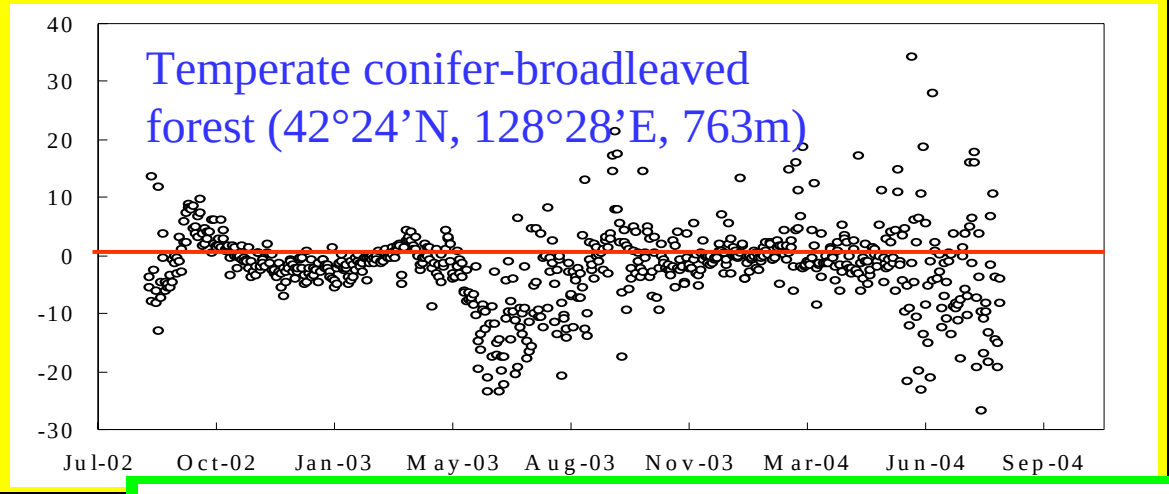

fresh water

# Observations and measurements *in situ*

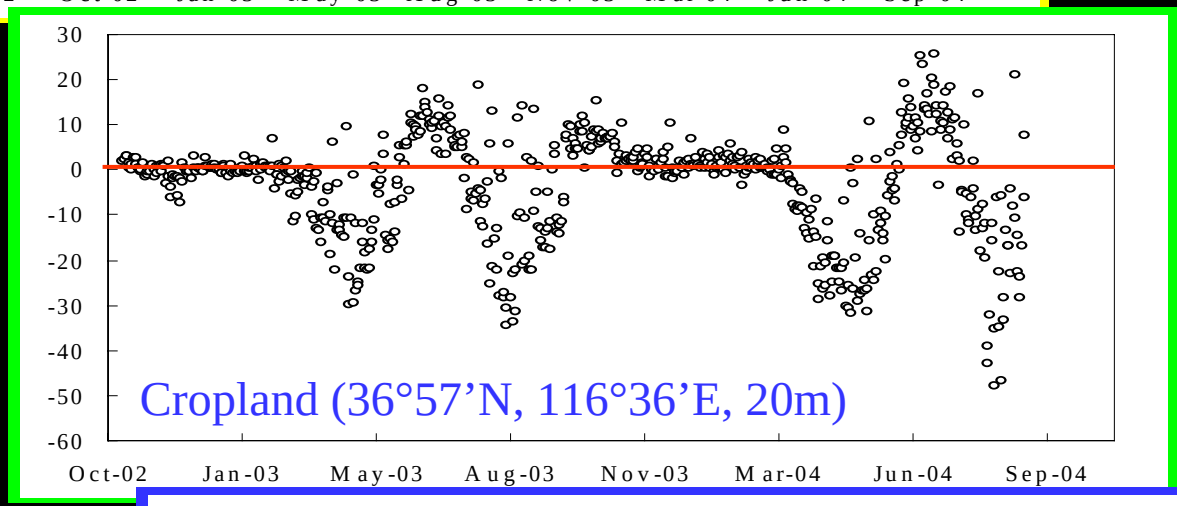
## (*Eddy Covariance*)

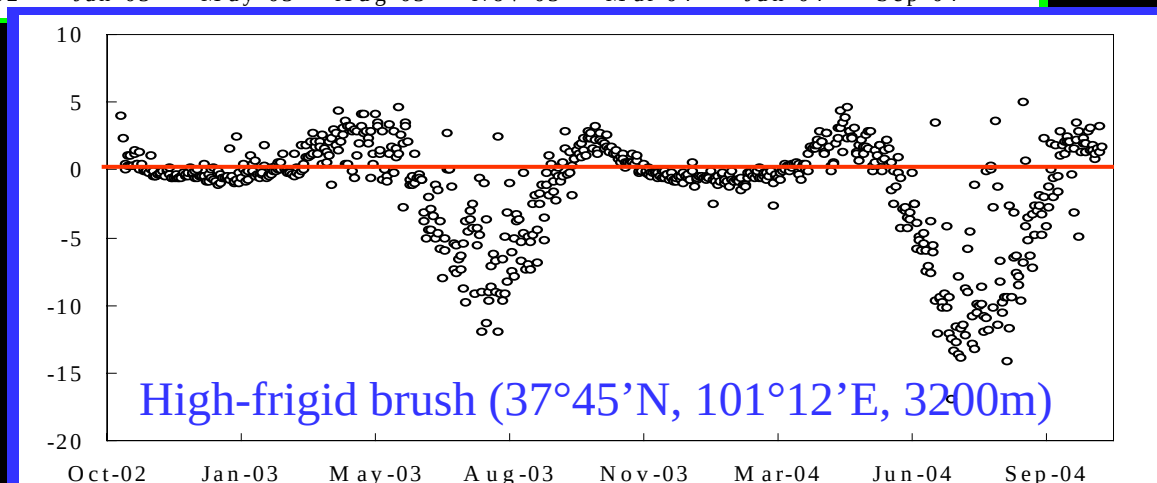
**Higher NEE in forest**

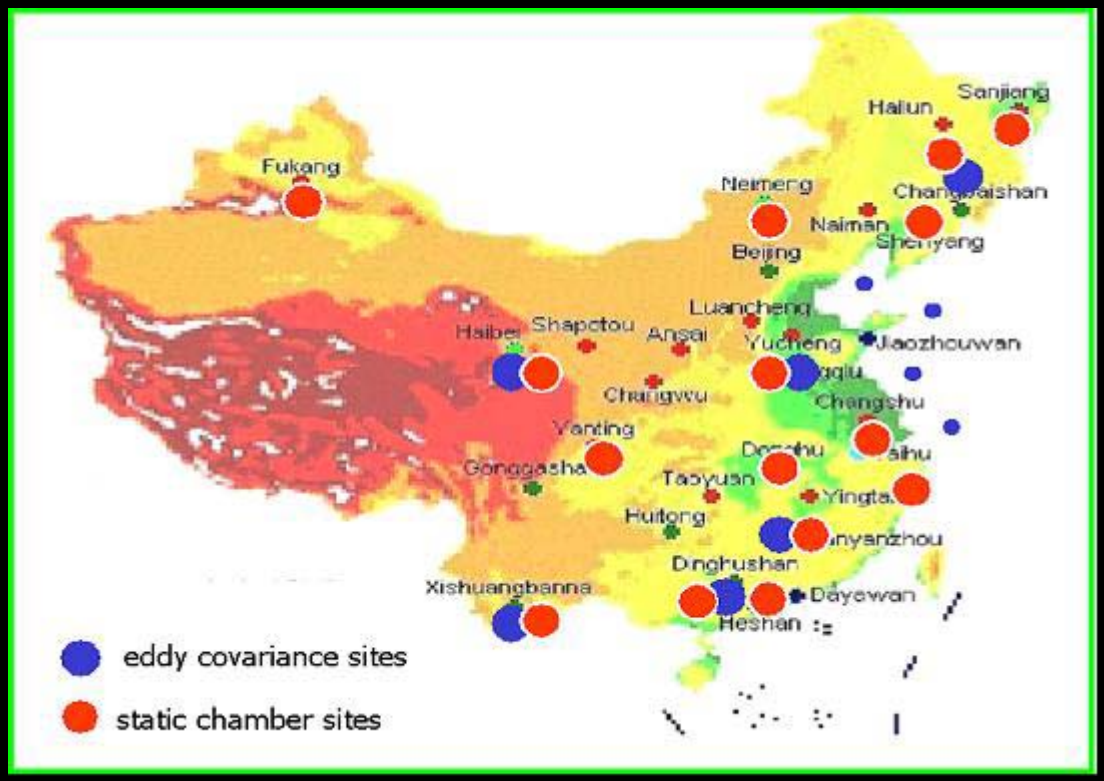



**Higher NEE in cropland**




**Lower NEE in high-frigid brush**

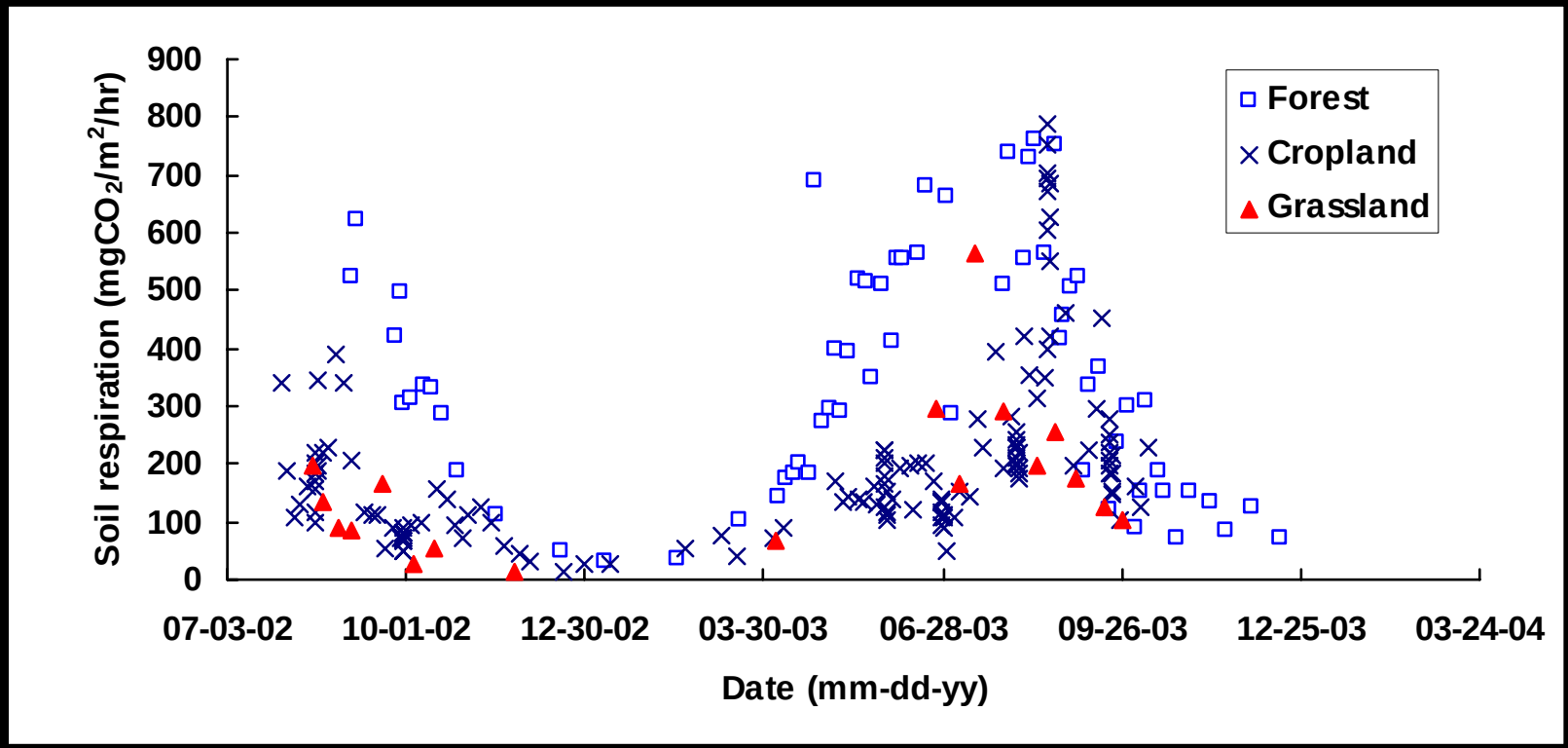





# Observations and measurements *in situ*

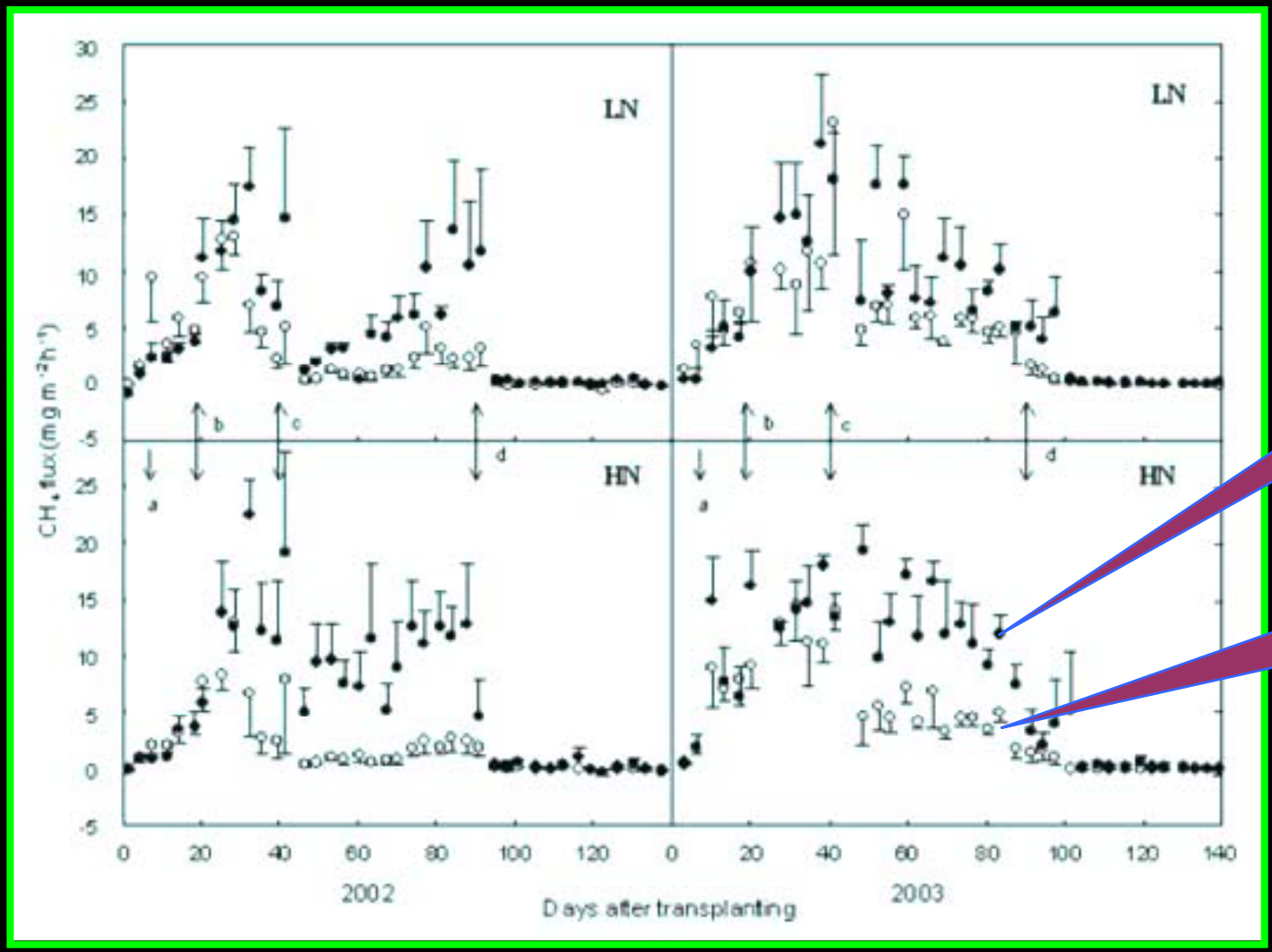
*Static chamber*

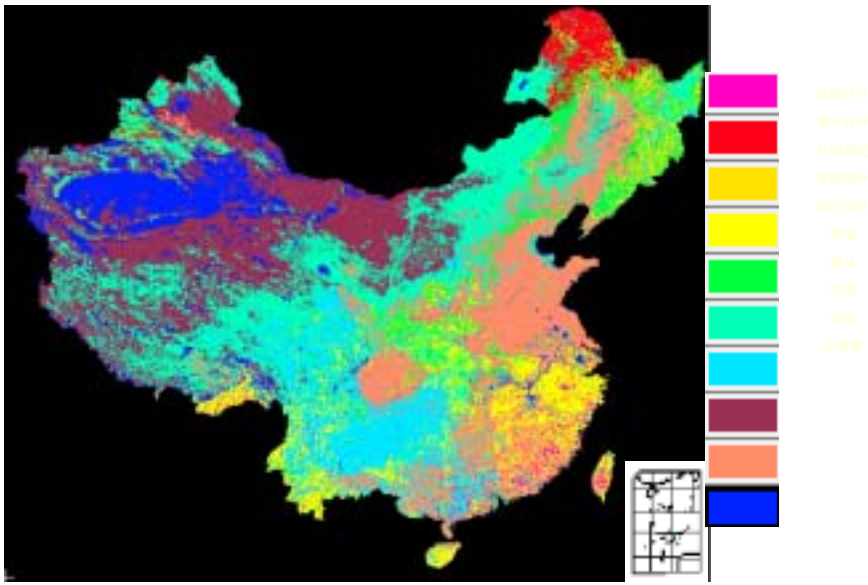
# Respiration from forest soil is higher than that from soils of cropland and grassland



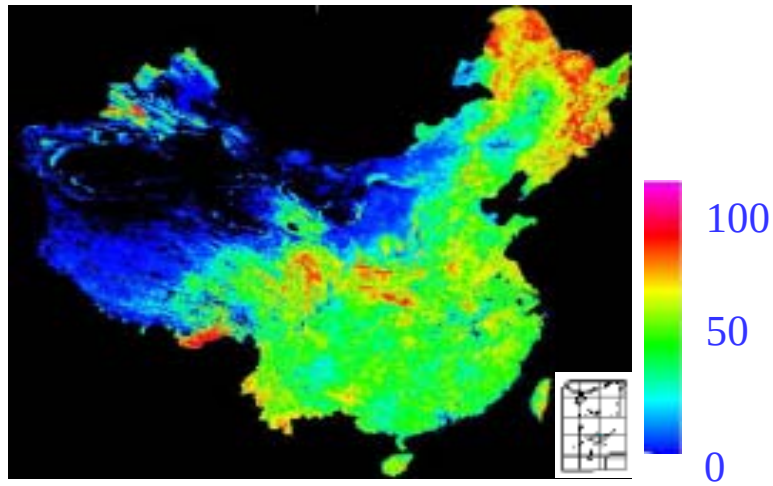

FACE ring 3, 2001/08/26

# Increased atmospheric $CO_2$ concentration enhanced $CH_4$ emission from rice paddy

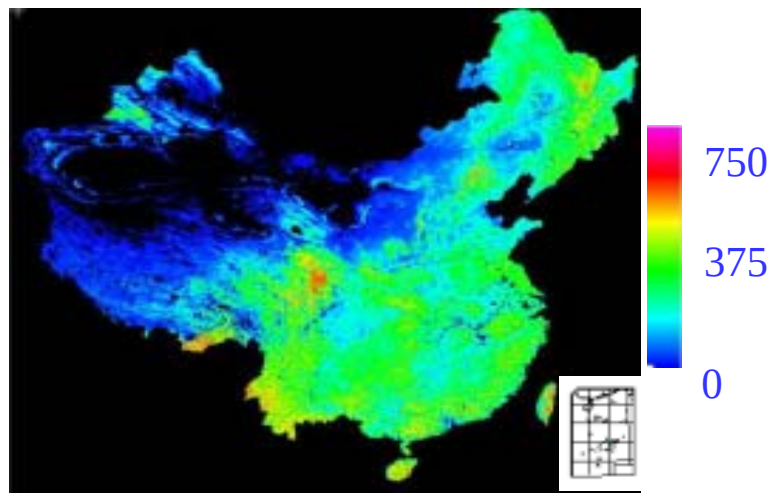




Identification of land cover from RS




Percentage of land cover from RS




Annual NPP from RS

# 2 Biogeochemical processes of C cycling in different ecosystems of China

**Key aspects:**

- Decomposition and retention of the litter-C in forest ecosystems as influenced by climate
- Processes of C cycling in typical pasture ecosystems such as temperate grass and high-frigid meadow grass
- Key factors and mechanisms regulating organic C balance in agricultural soils

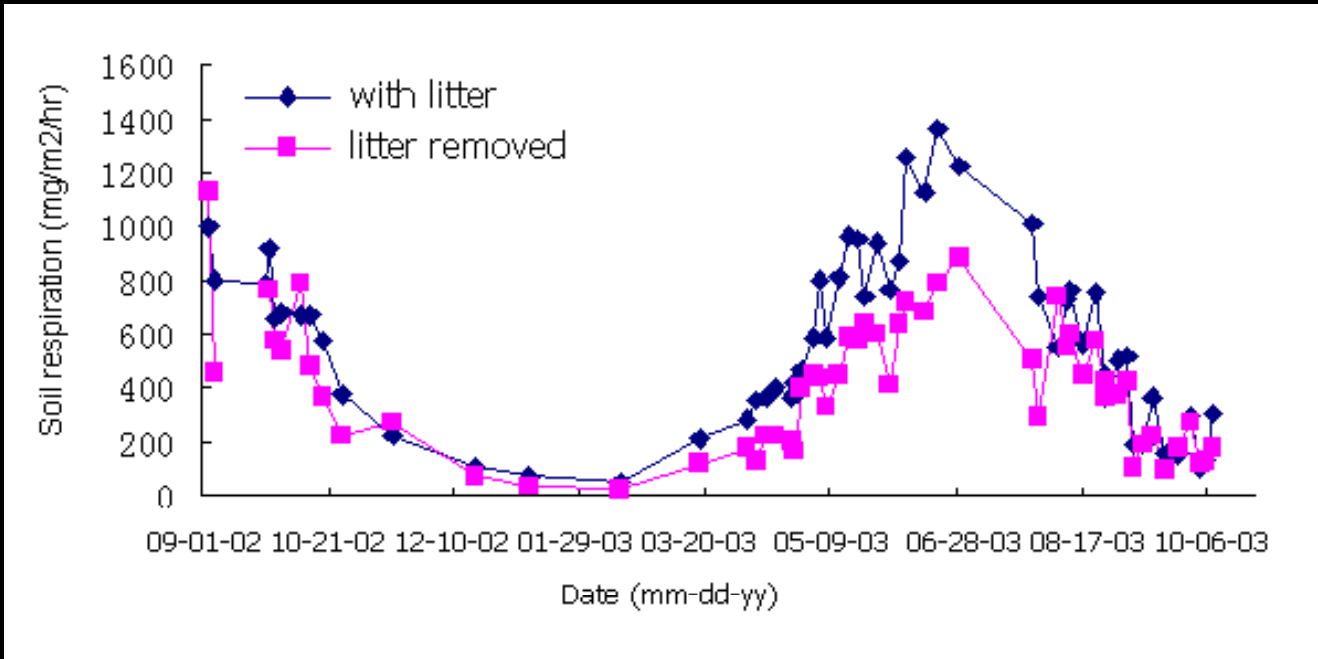




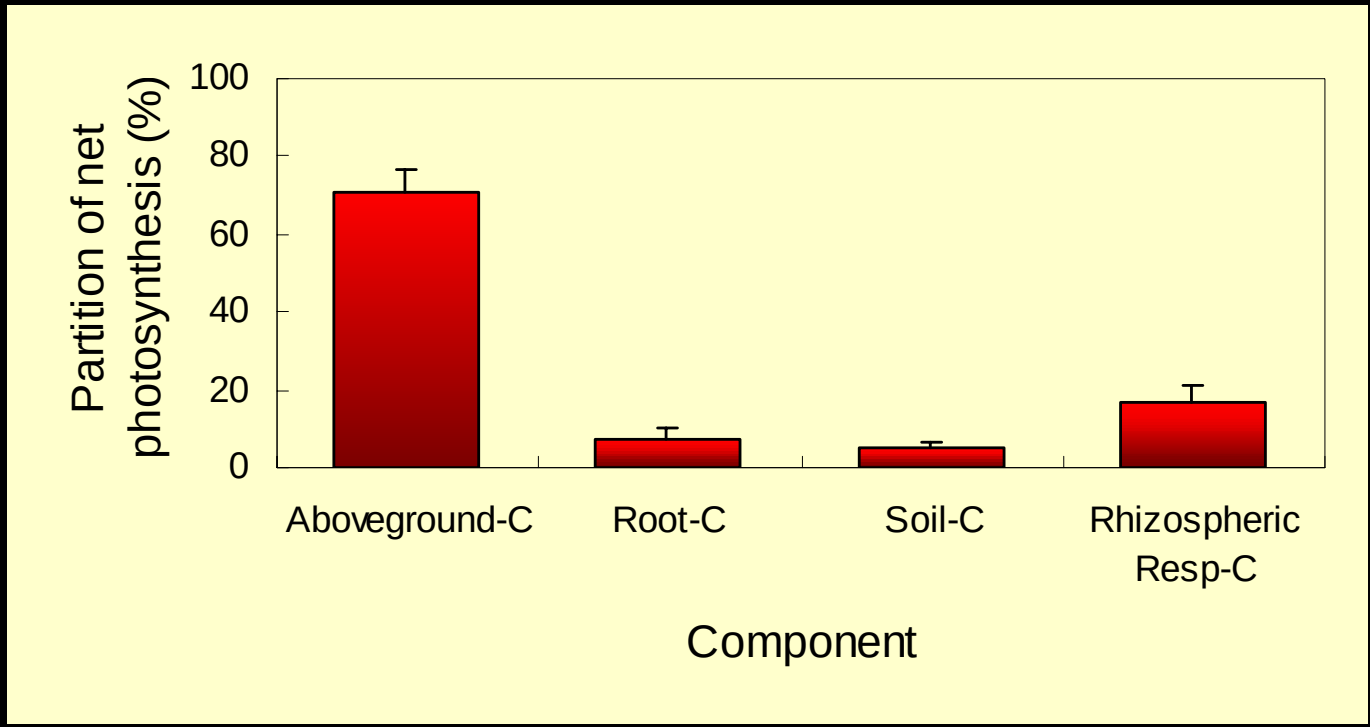


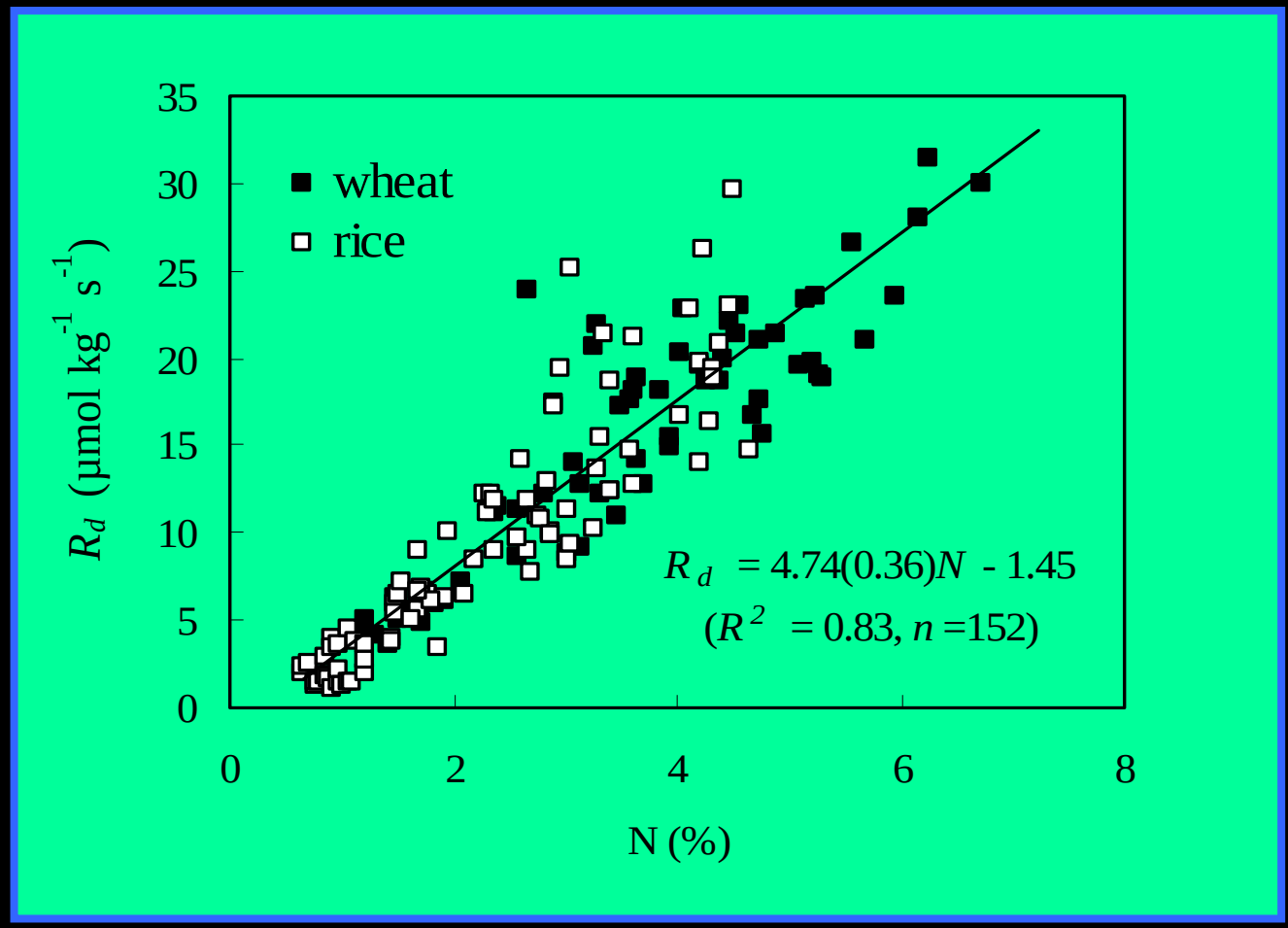


**Carbon released from litter decomposition accounted for ~30% of soil respiration in temperate conifer-broadleaved forest**



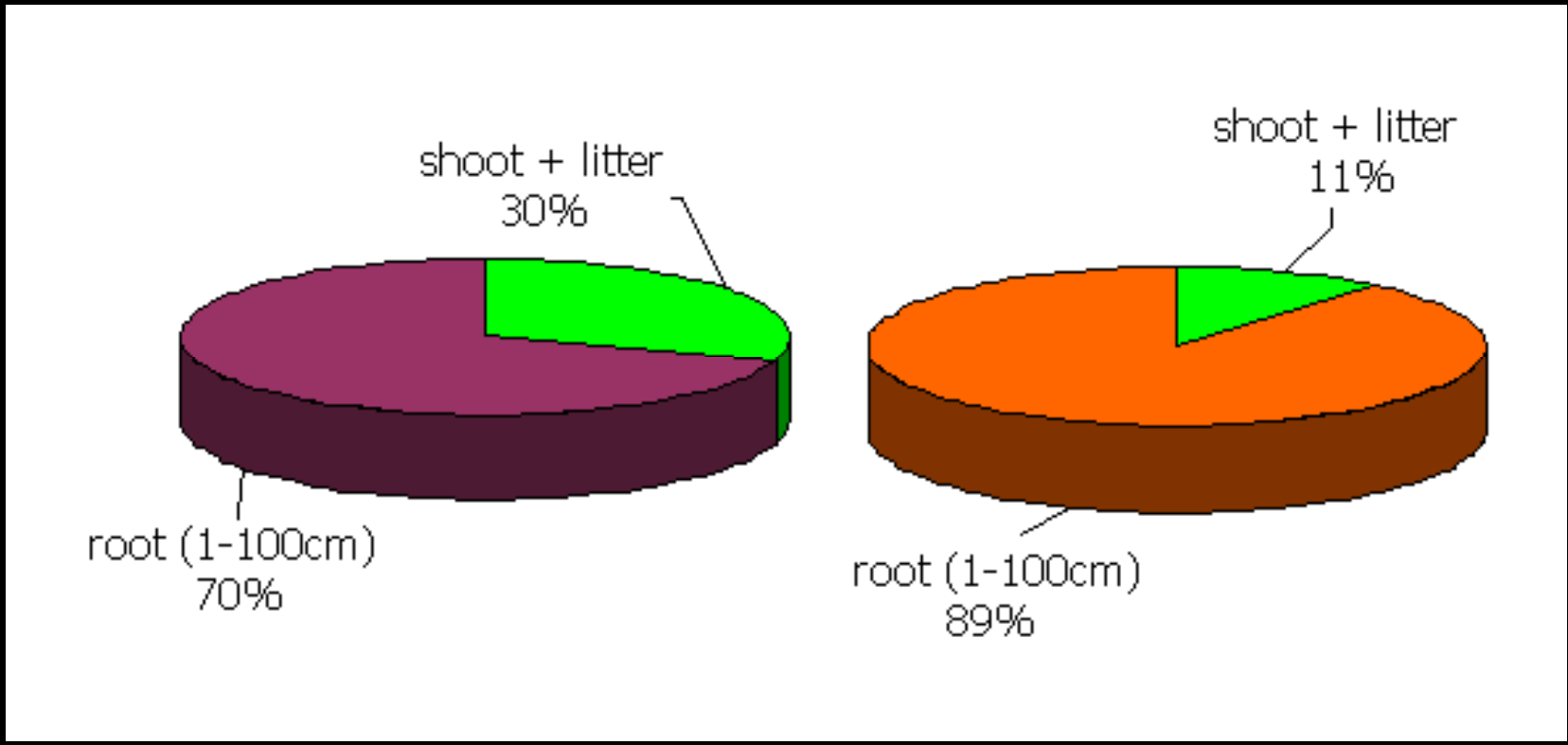
**Some 17% of net photosynthesis of maize and soybean is released through rhizospheric respiration**






**Crop dark respiration increased with tissue N concentration**

# Plant root contributes greatly to soil carbon in grassland



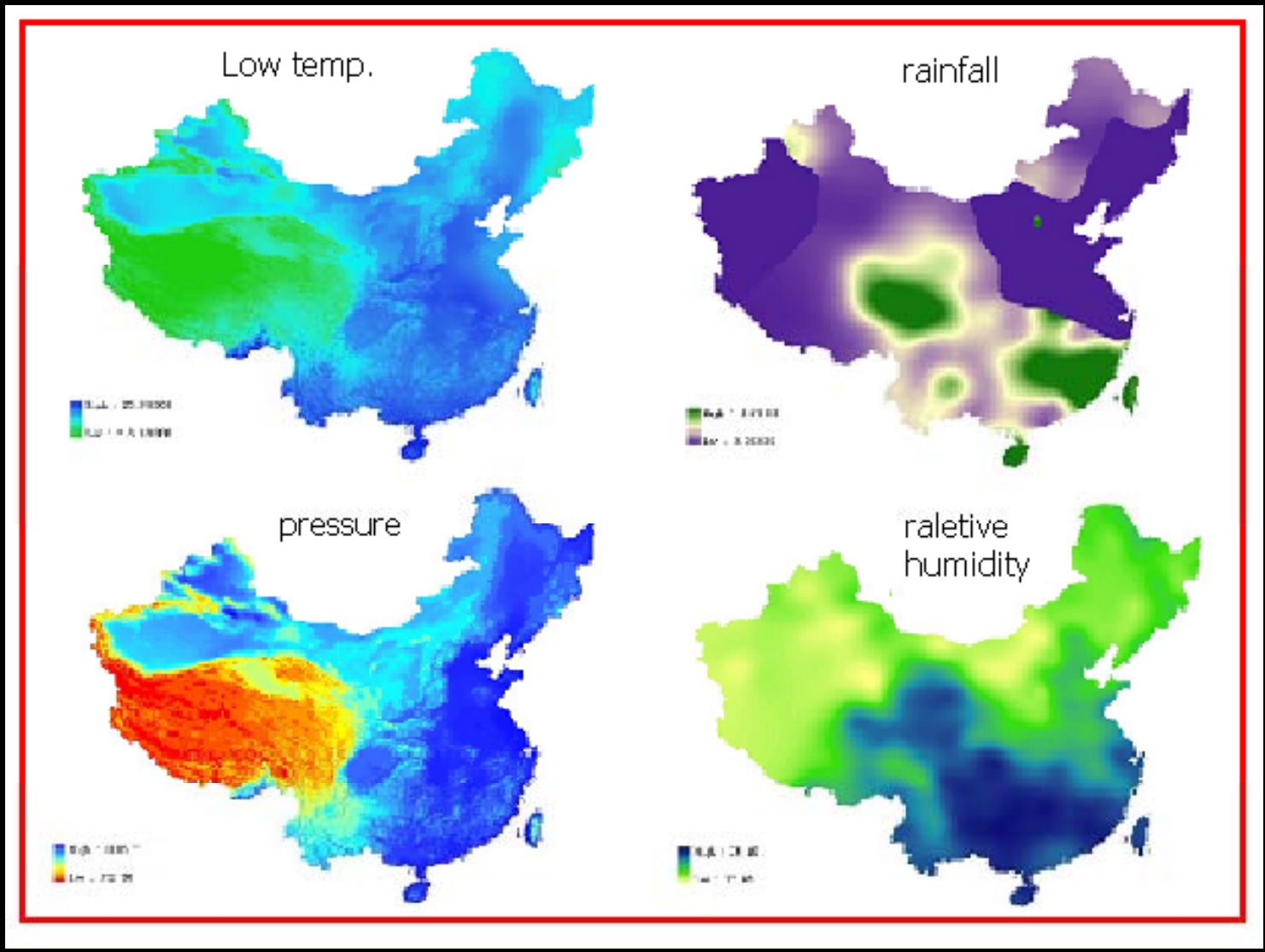
# 3 Patterns of C sinks and sources and the response to global change

**Key aspects:**

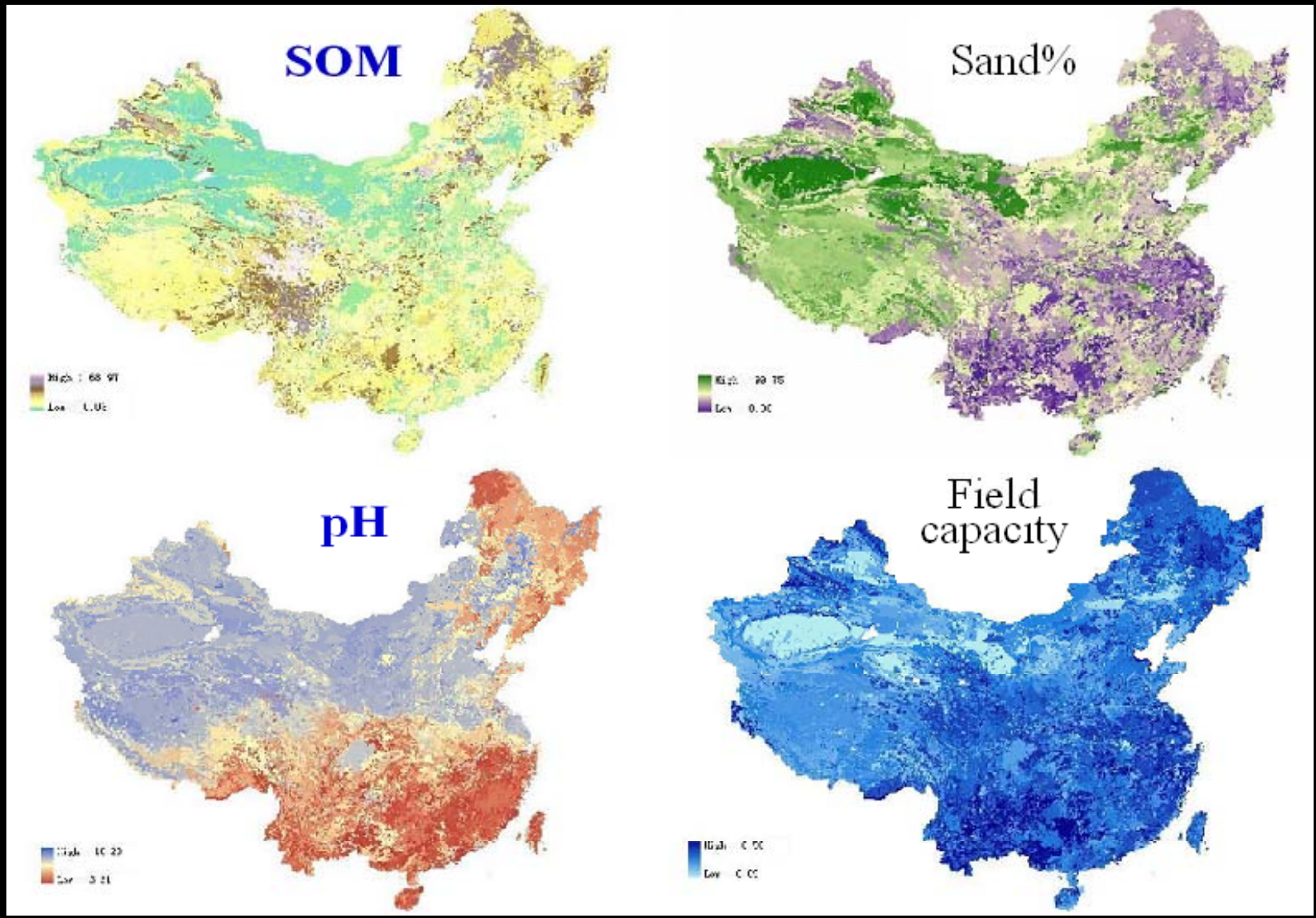
- Modeling C emission/assimilation
- Integration of C models with GCMs, GIS and RS
- Geographical and temporal patterns of C sources and sinks
- Response of different ecosystems to the global change

**Models are developed for the sections of forest, grassland, cropland and wetland, respectively.**

**Upscaling: integration of models and GIS and RS**




**Upscaling: daily weather (10km× 10km）**




**Upscaling: soil parameter (10km× 10km)**

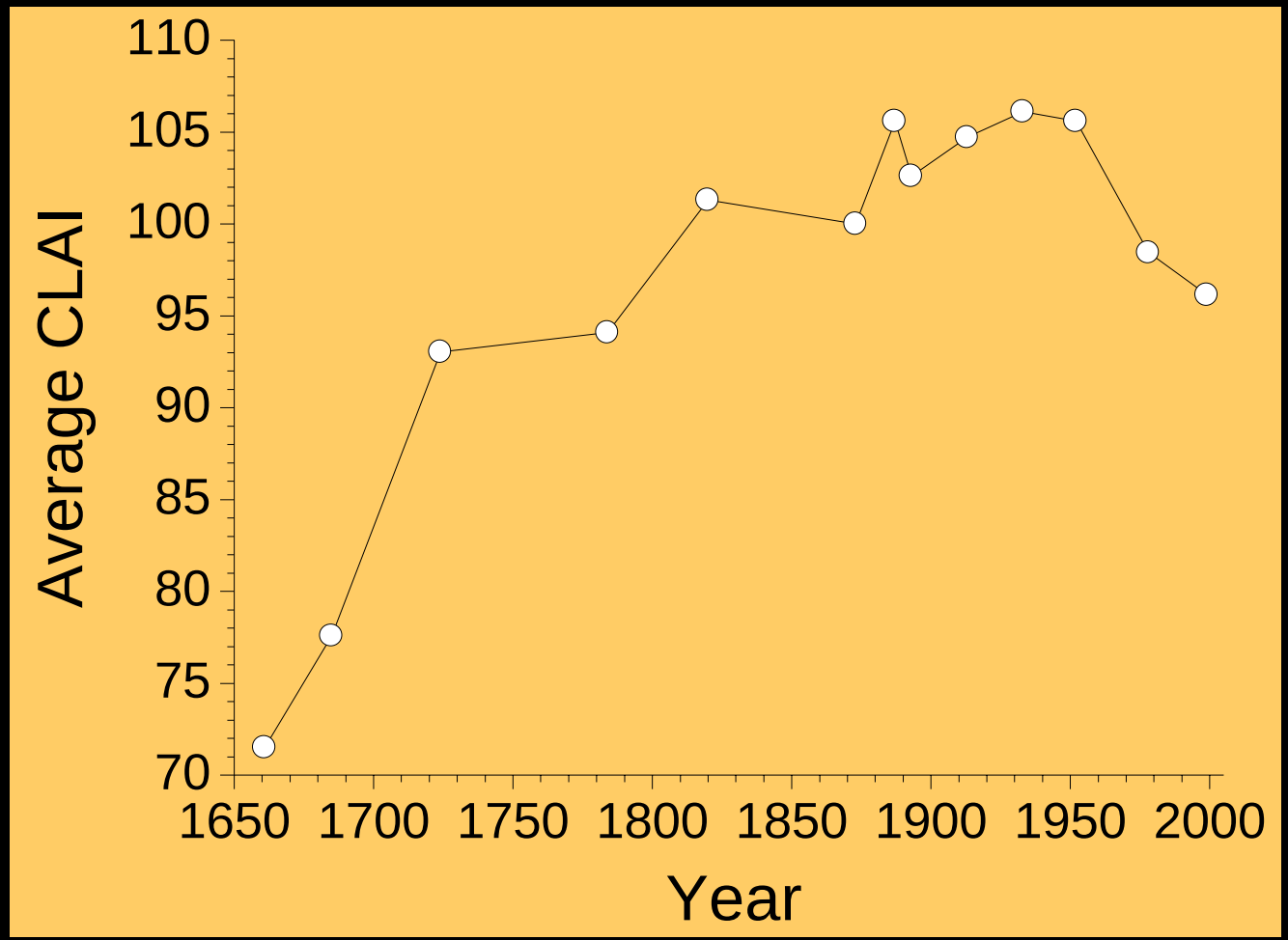

**Upscaling: cropping system (10km×10km)**

# 4 LUCC and mitigation options

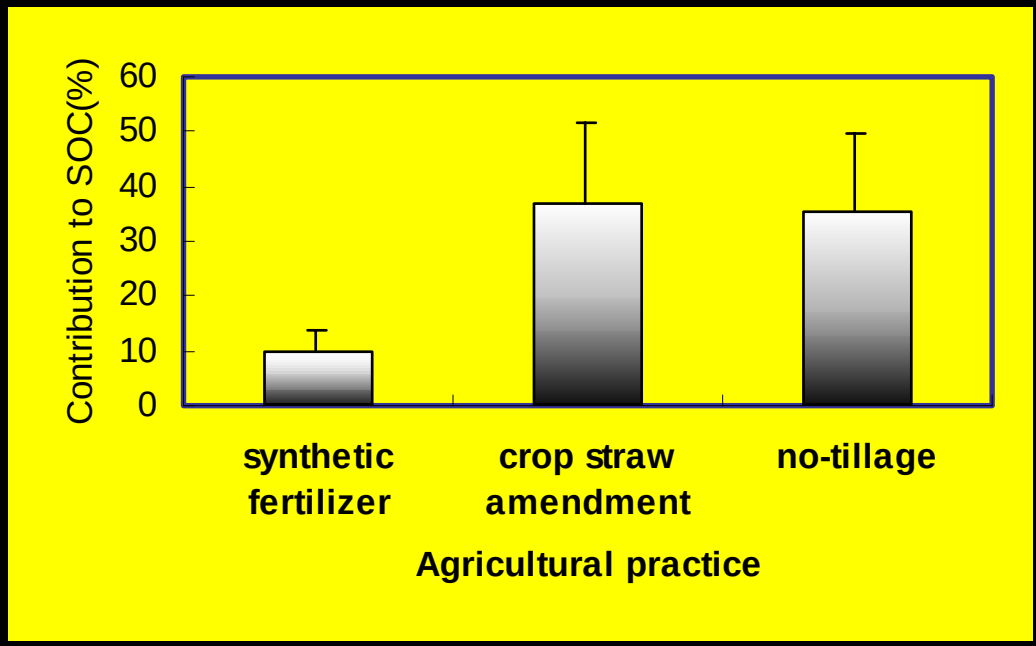
## Key aspects:

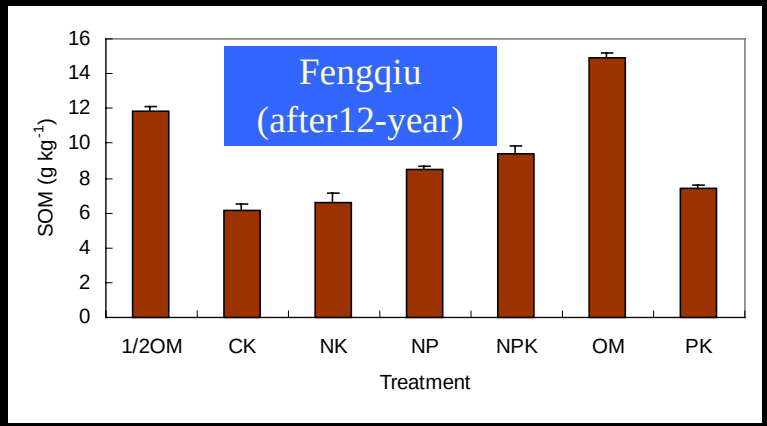
- Contribution of LUCC to the C cycling
- Options for mitigating C emissions and/or enhancing C storage

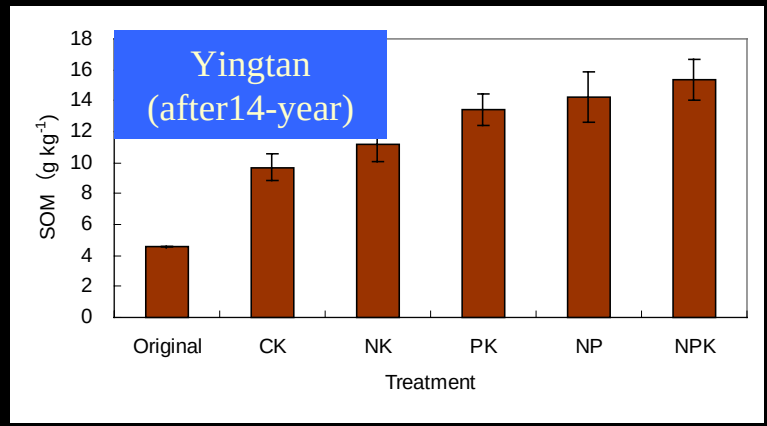
# Arable land increased from 1661 to 1950 while decreased thereafter



# There is a great potential for enhancing C storage in agricultural soils



# Institutes are involved in the CBTSEC

- Institute of geography science and resource
- Institute of Atmospheric Physics
- Institute of Applied Ecology
- Institute of Soil Sciences
- Institute of Botany Sciences
- Institute of Remote Sensing
- Center of Ecology and Environment Sciences
- Chinese Ecosystem Research Network
- …

# Thank You


International workshop on flux observation and research in Asia
Dec. 1-3, 2003, Beijing