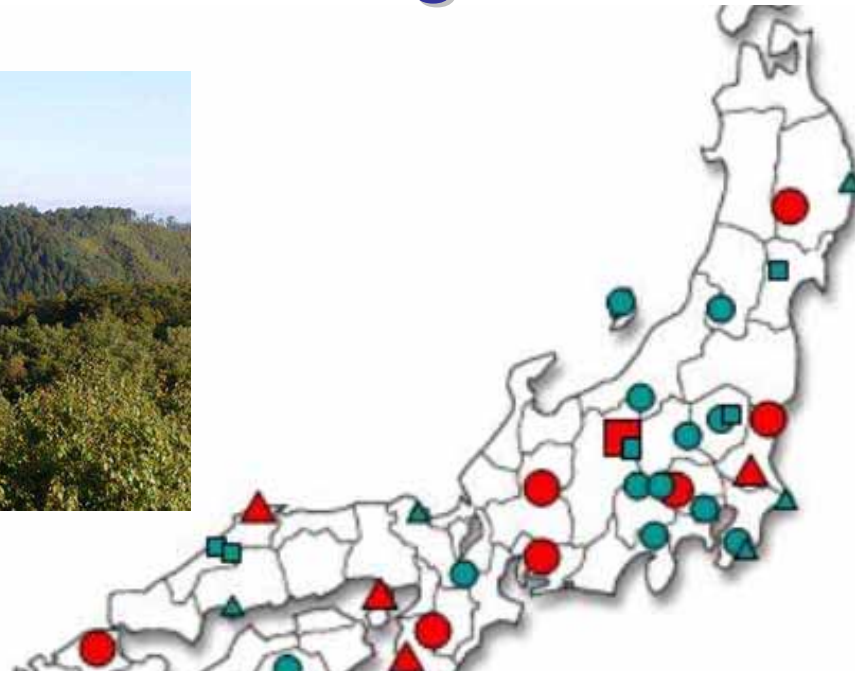


Challenges of JaLTER toward interdisciplinary study on ecosystem adaptation under global changes



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Contents

- Need of interdisciplinary ecosystem study
- What's JaLTER?
- Challenge of JaLTER
 - Long-term study of ecosystem process
 - Cross-site analysis
 - Data archiving and sharing

Human system needs strategy for adaptation and mitigation under predicted global change.

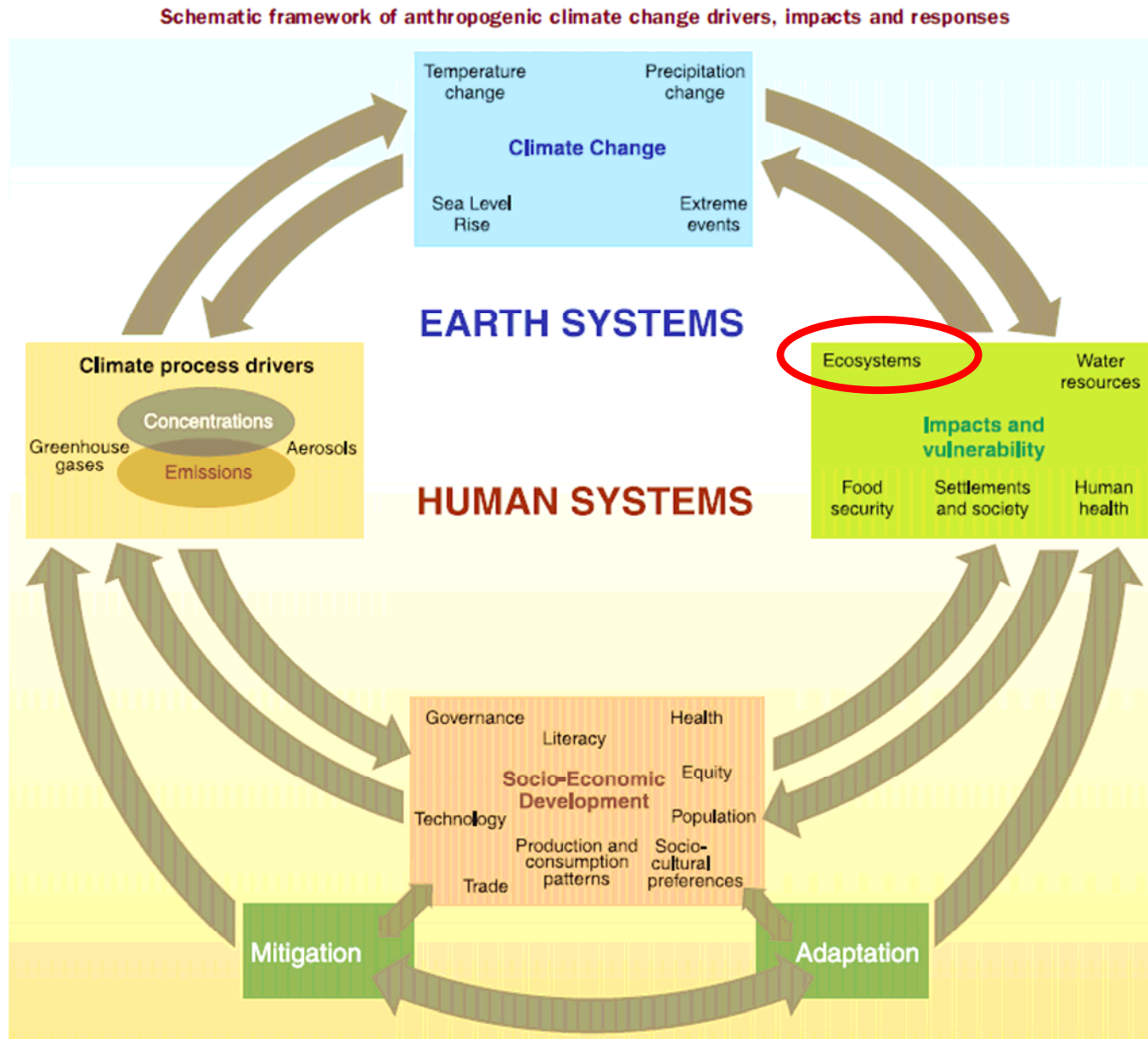


Figure 1.1. Schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages.

Importance of Ecosystem in GEOSS

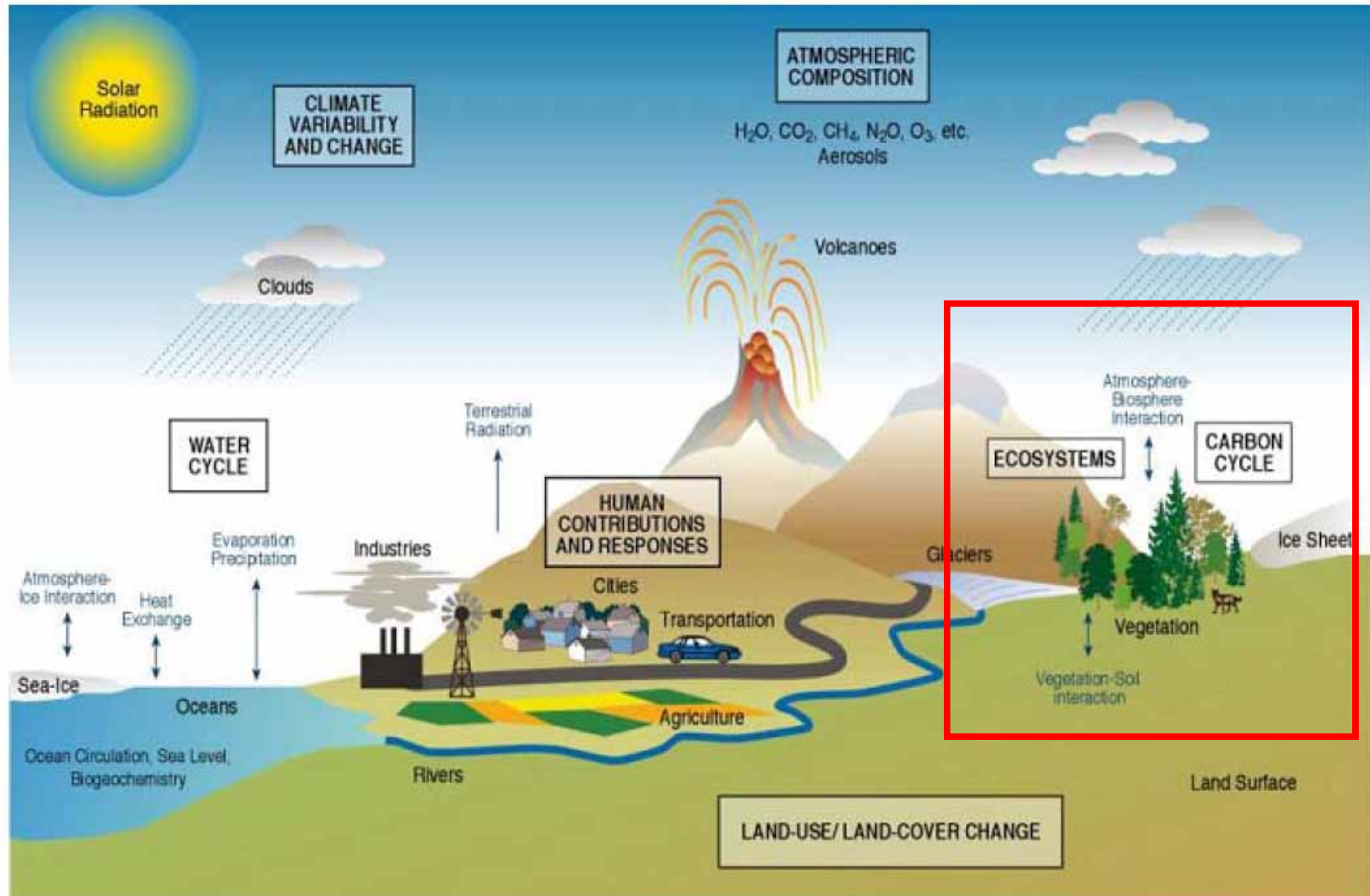
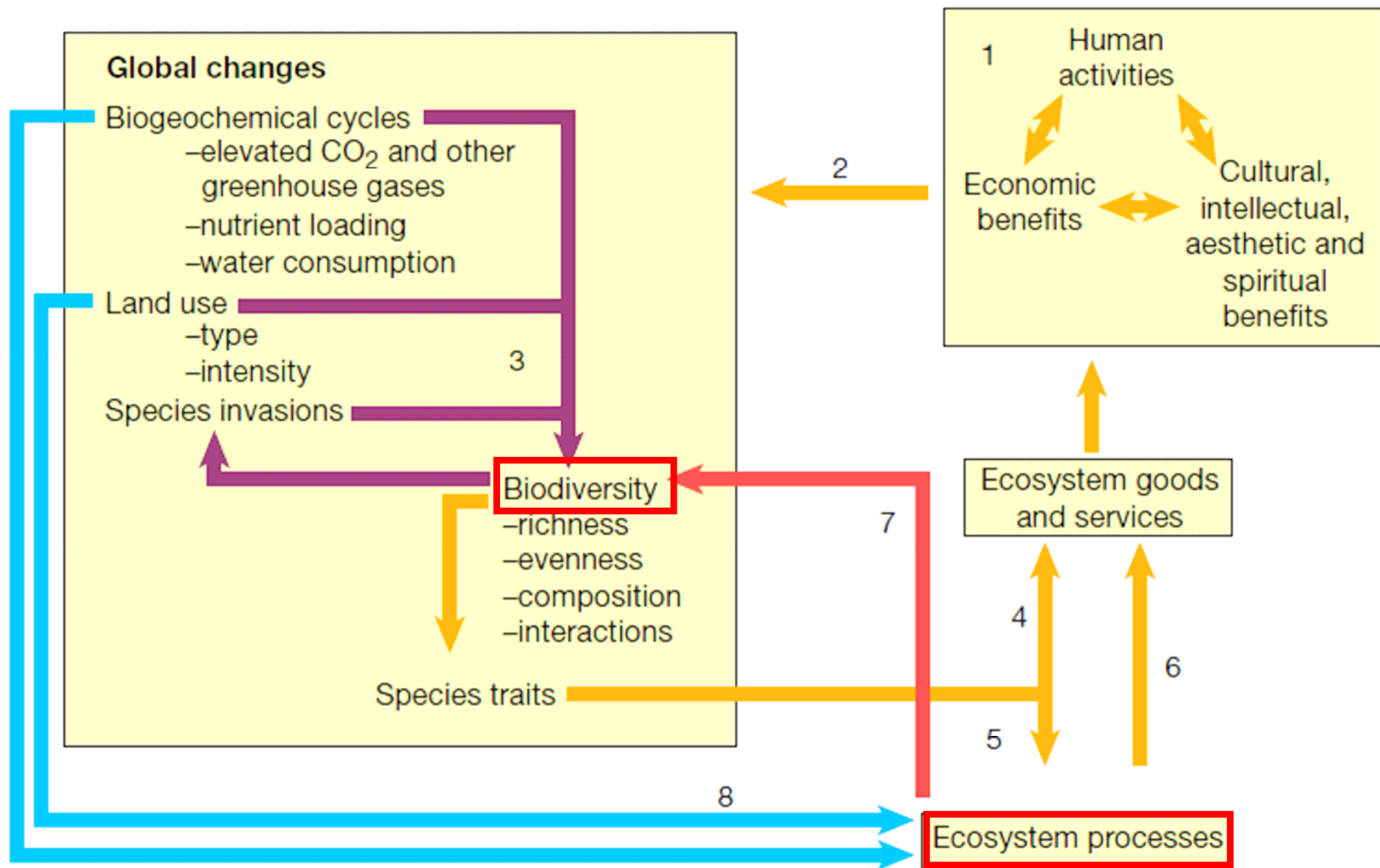


Diagram of the Earth System

(GEO Information Sheet 2008)

Ecosystem and biodiversity under global change



(Chapin *et al.* 2000: *Nature* **405**: 234-242)

Global and continental temperature change

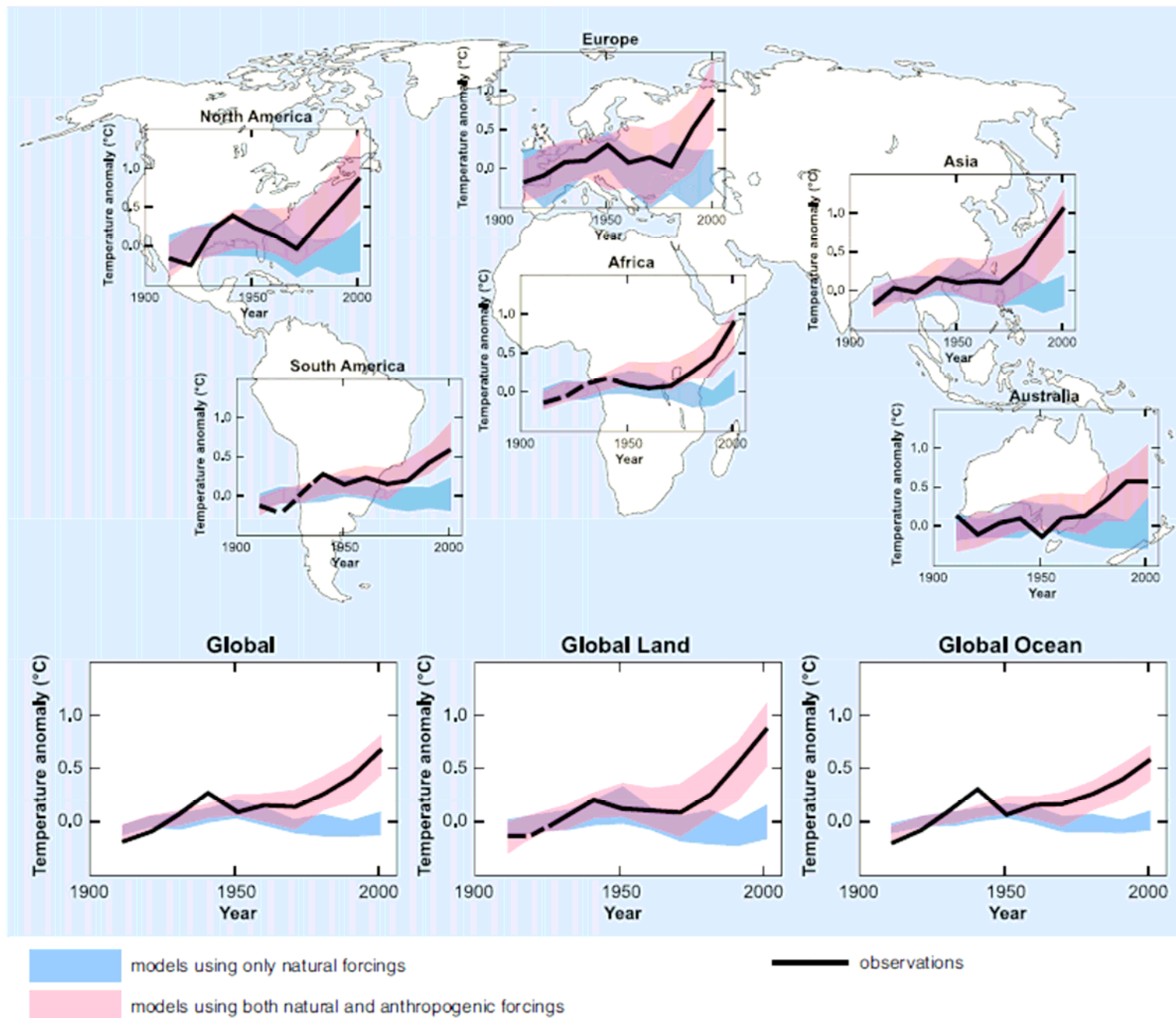
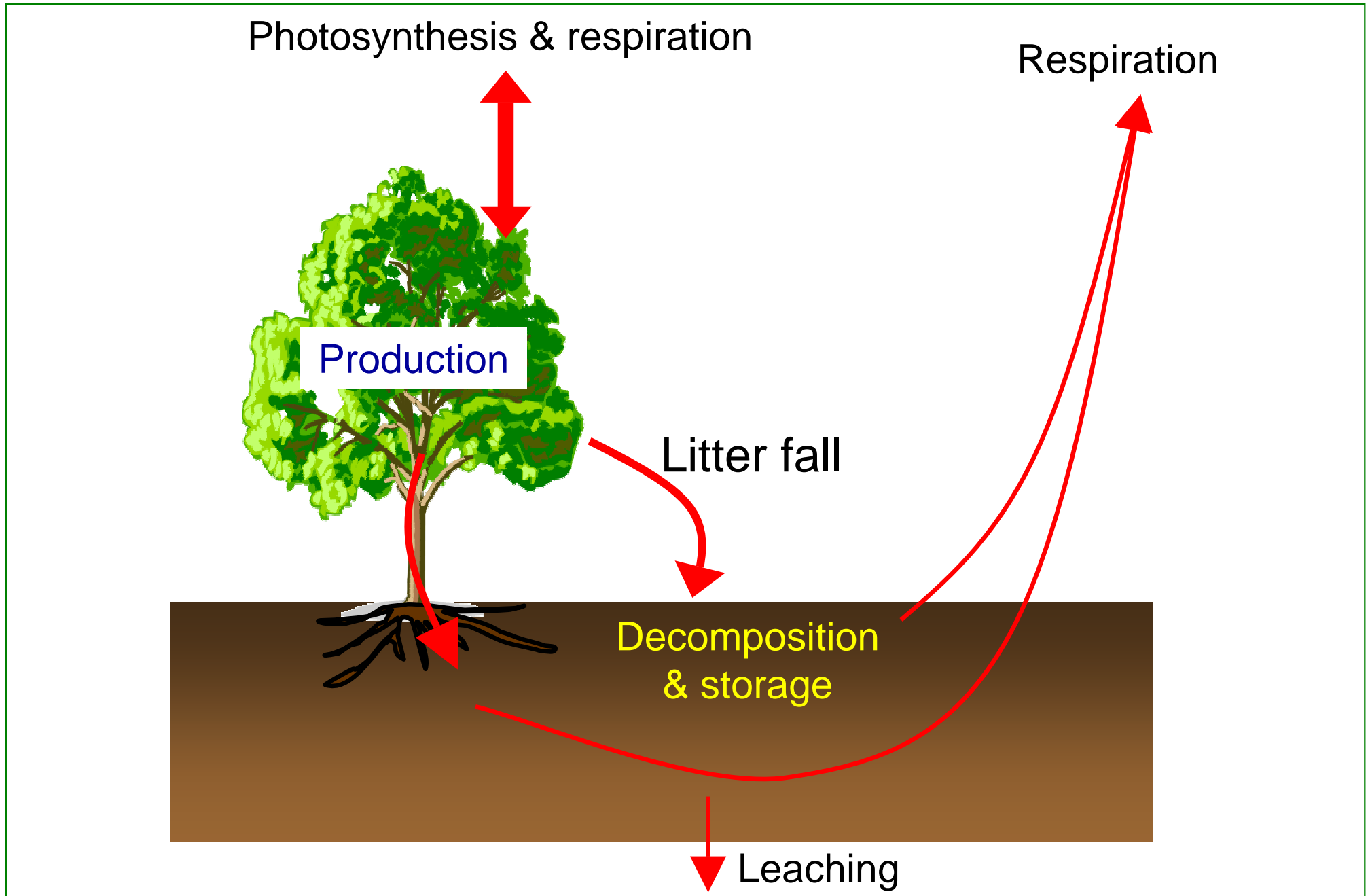


Figure 2.5. Comparison of observed continental- and global-scale changes in surface temperature with results simulated by climate models using either natural or both natural and anthropogenic forcings. Decadal averages of observations are shown for the period 1906-2005 (black line) plotted against the centre of the decade and relative to the corresponding average for the 1901-1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5 to 95% range for 19 simulations from five climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5 to 95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings. [WGI Figure SPM.4]

Ecosystem function under the global climate change

--- *Inter-related processes of carbon cycle in terrestrial ecosystem* ---



Carbon uptake by terrestrial ecosystem (FLUXNET: Baldocchi et al. 2001)

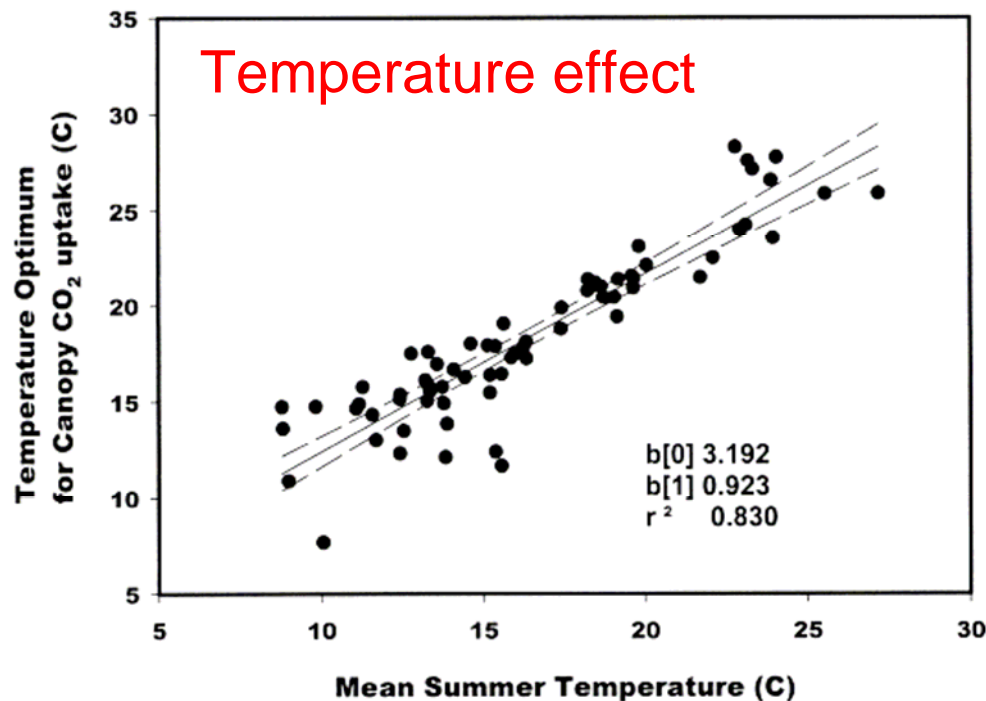


FIG. 9. The relation between the optimum temperature for canopy-scale gross primary productivity vs maximum mean monthly air temperature during the summer growing season. These data show how photosynthesis adapts to climate. Here $b(0)$ is the zero intercept and $b(1)$ is the slope of the regression curve, and r^2 is the coefficient of determination. Dashed lines are the standard error of the regression at the 95% level.

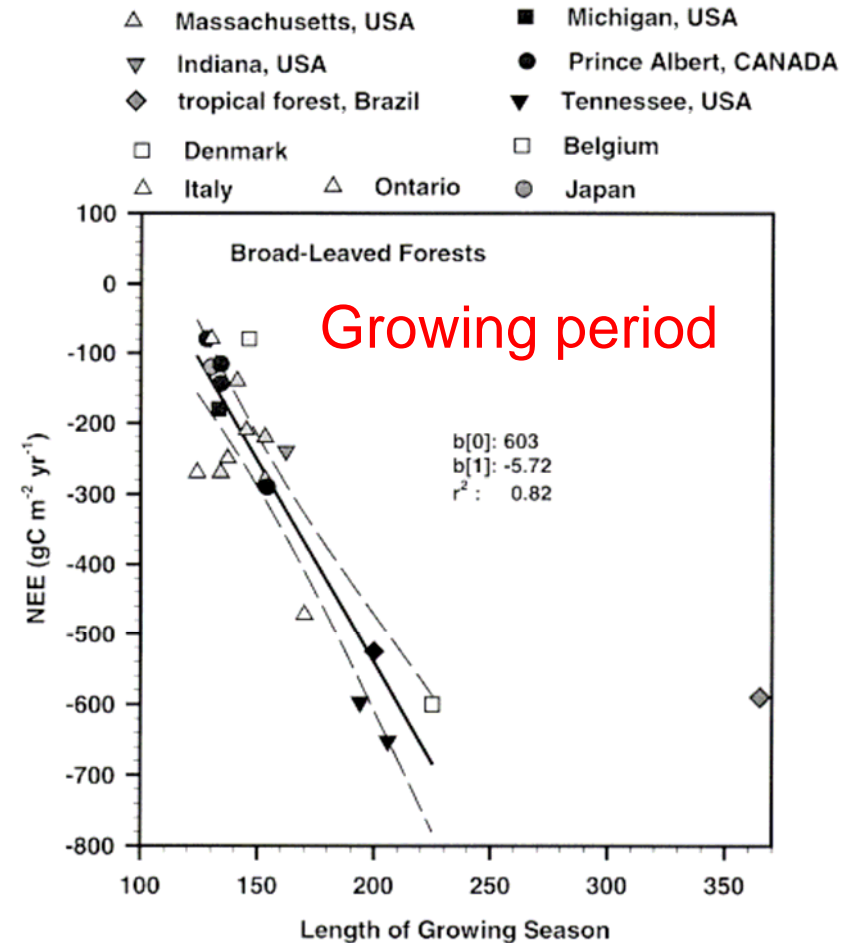


FIG. 4. Annual net ecosystem CO₂ exchange: Impact of length of growing season (in days) on temperate broadleaved forests and one tropical forest (Brazil). Here, b_0 is the zero intercept and b_1 is the slope of the regression curve, and r^2 is the coefficient of determination. Dashed lines are the standard error of the regression at the 95% level.

Control of temperature and nitrogen on C uptake

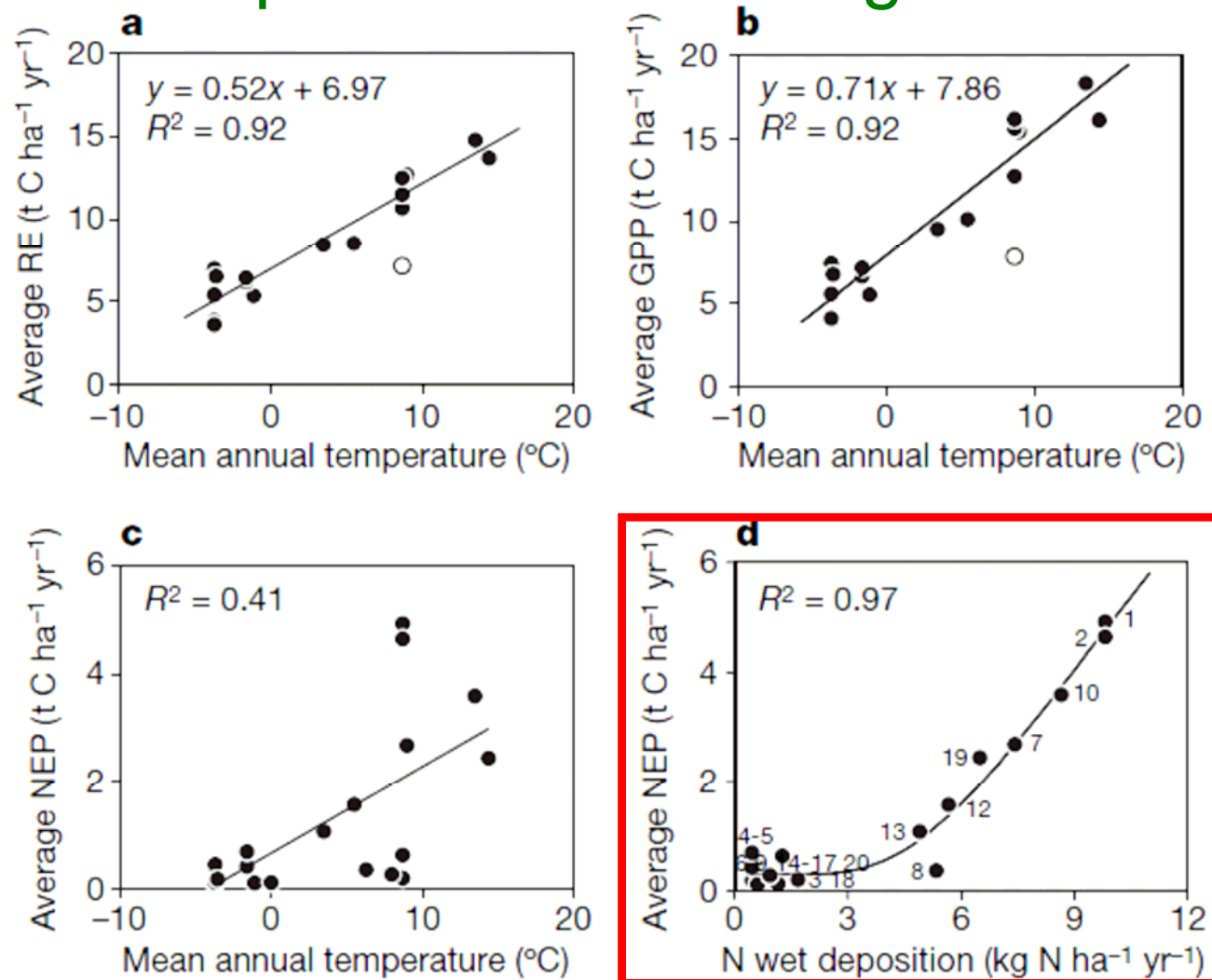
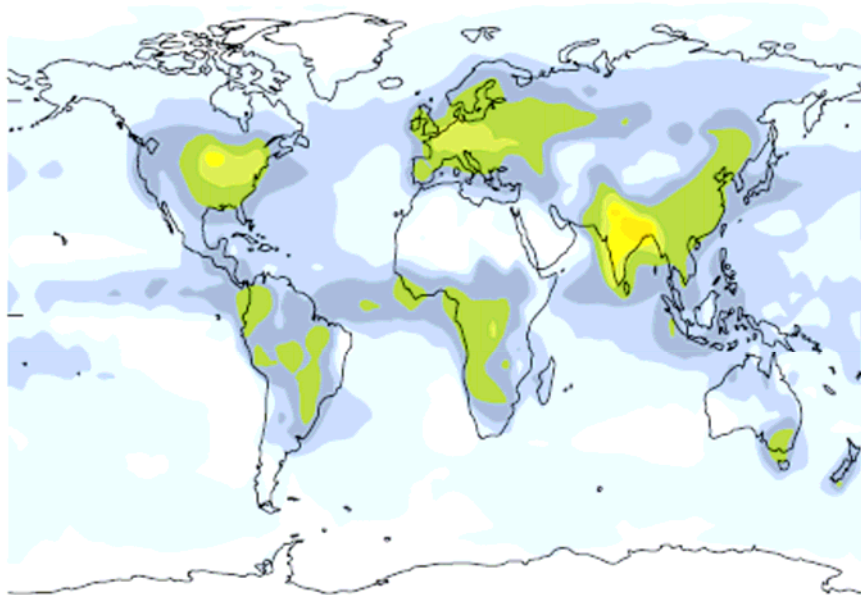
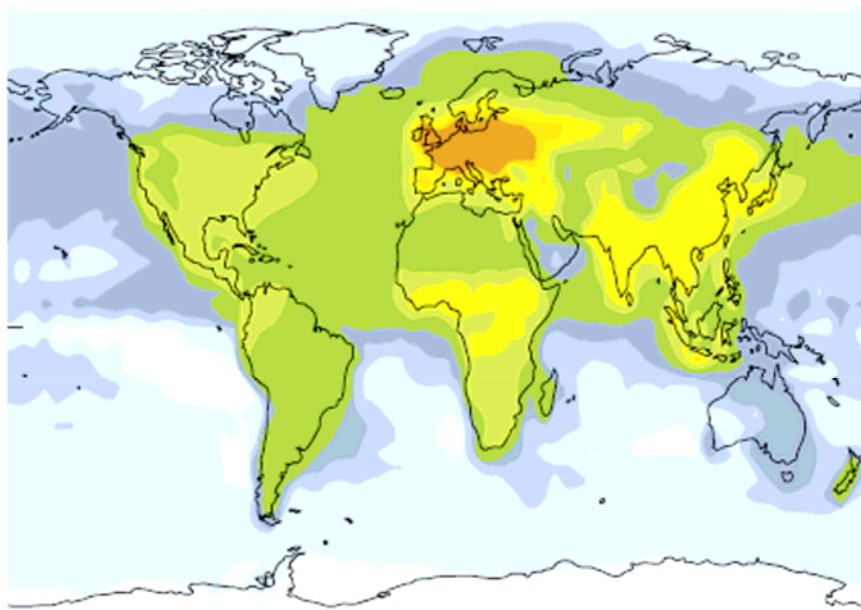


Figure 3 | Environmental control of average C exchange over an entire rotation. Linear relationships between average RE (a) and average ecosystem GPP (b) and mean annual temperature at the study sites. In both a and b, the only drought-prone site⁹ (white circle) has been excluded from the analysis. c, Average NEP is only poorly correlated to temperature. d, Average NEP is strongly related to N deposition. Numbers refer to site codes in Table 1. An Arrhenius function has been empirically fitted onto the entire data set ($n = 20$).

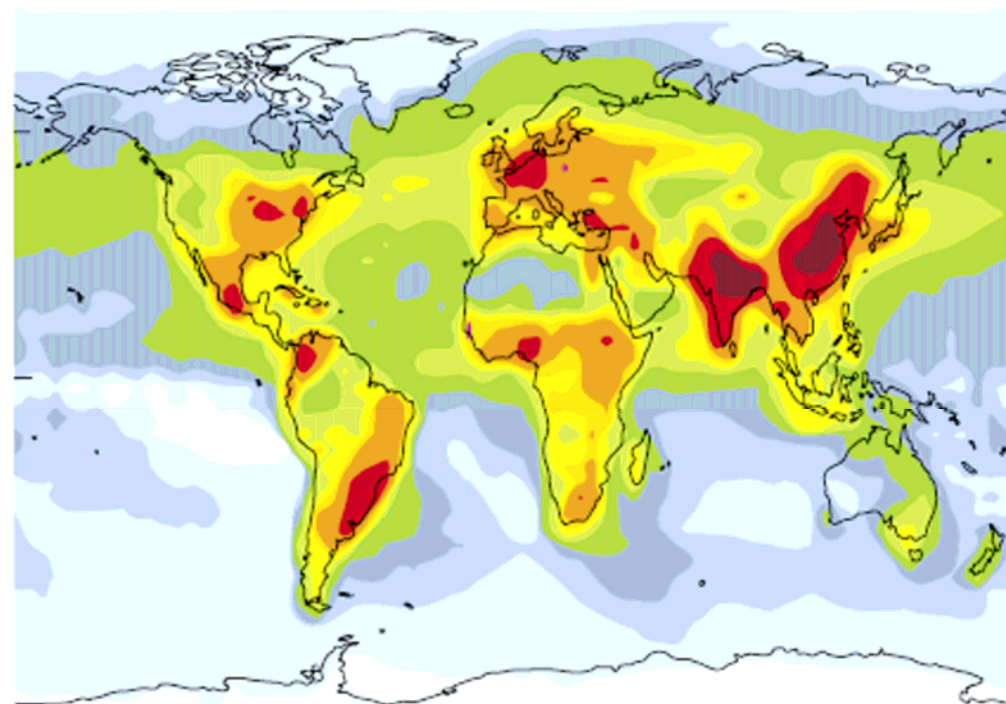
(Magnani et al. 2007, *Nature* 447: 848-850)



1860



Early 1990s



2050

mg nitrogen per sq. meter per year

5 25 50 100 250 500 750 1 000 2 000 5 000

Source: Galloway et al. 2004

Future increase of nitrogen pollution

(Galloway et al; MA Synthesis 2005)

Change of litter decomposition associated with nitrogen nutrition would control nutrient supply for plant and carbon storage in soil.

Progressive nitrogen limitation under climate change

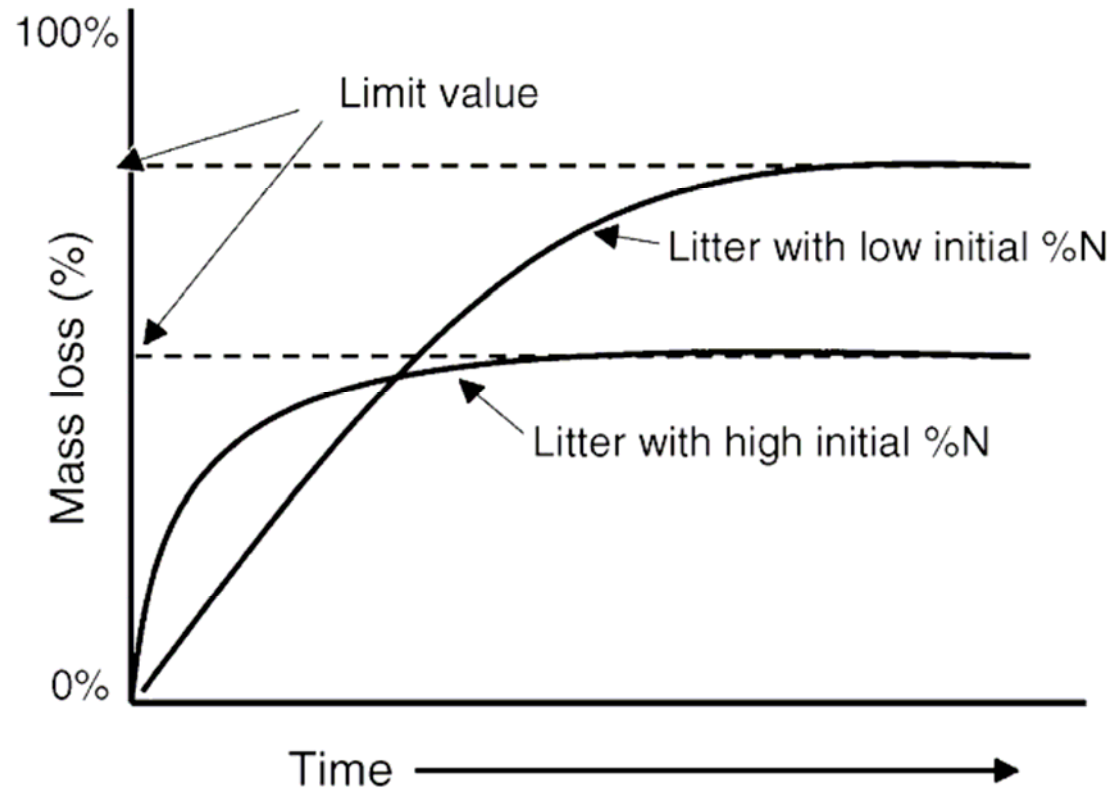


FIG. 4. Schematic representation of the theoretical changes in loss of litter mass over time with high and low initial N concentrations. The figure is adapted from Berg and McClaugherty (2003).

(Johnson et al. 2006, *Ecology* **87**: 64-75)

Biodiversity also affect ecosystem productivity affected by elevated CO₂ and nitrogen.

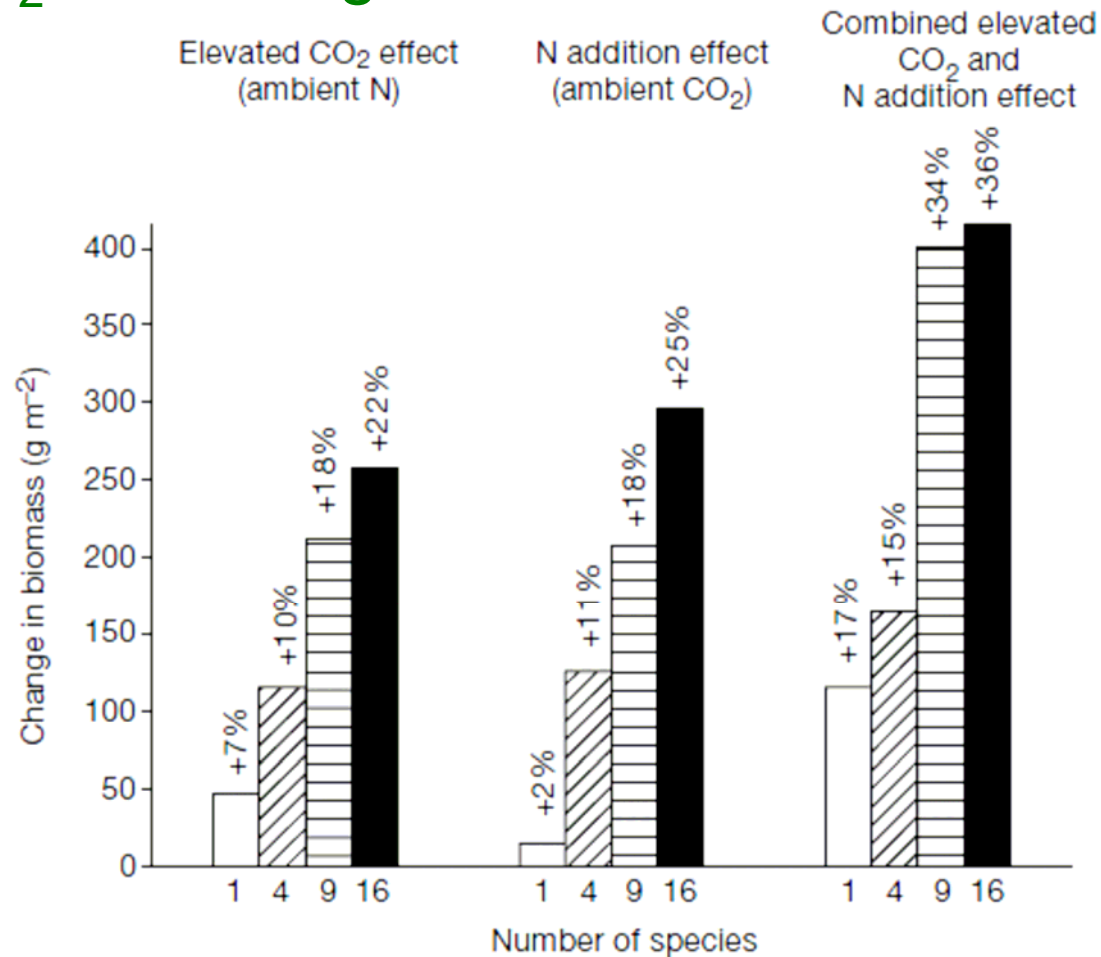


Figure 2 Change in total (above-ground plus 0–20 cm below-ground) biomass (compared with ambient levels of both CO₂ and N) in response to elevated CO₂ alone (at ambient soil N), to enriched N alone (at ambient CO₂), and to the combination of elevated CO₂ and enriched soil N, for plots containing 1, 4, 9 or 16 species. Data were averaged for 4 harvests over 2 yr. Per cent change is shown above each histogram for each diversity treatment.

(Reich *et al.* 2001, *Nature* **410**: 809-812)

From carbon fertilization to saturation and loss

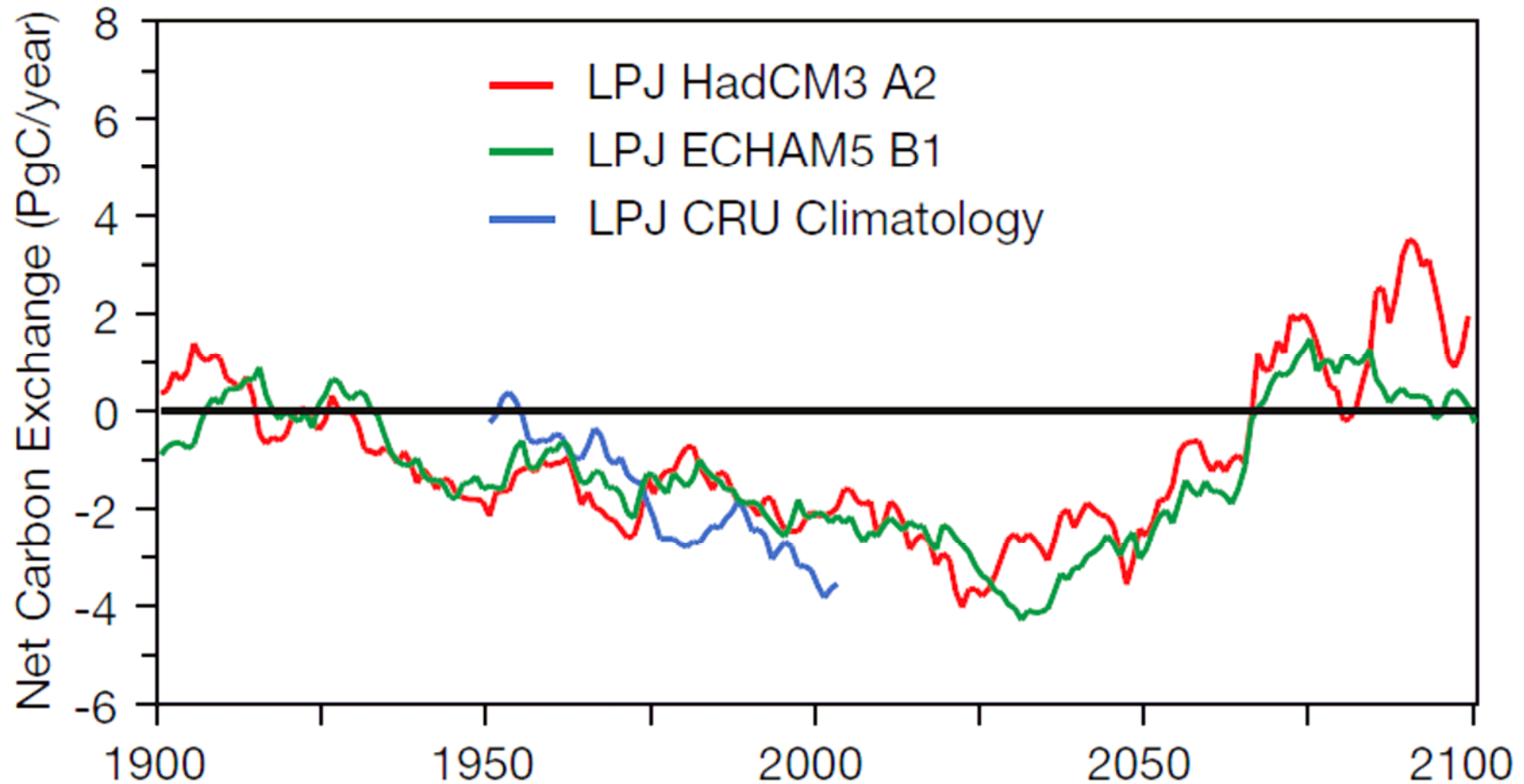


Figure 4.2. Net carbon exchange of all terrestrial ecosystems as simulated by the DGVM LPJ (Sitch et al., 2003; Gerten et al., 2004 – negative values mean a carbon sink, positive values carbon losses to the atmosphere). Past century data are based on observations and climate model data were normalised to be in accord with these observations for the 1961-1990 data (CRU-PIK). Transient future projections are for the SRES A2 and B1 emissions scenarios (Nakićenović et al., 2000), forcing the climate models HadCM3 and ECHAM5, respectively (cf. Lucht et al., 2006; Schaphoff et al., 2006).

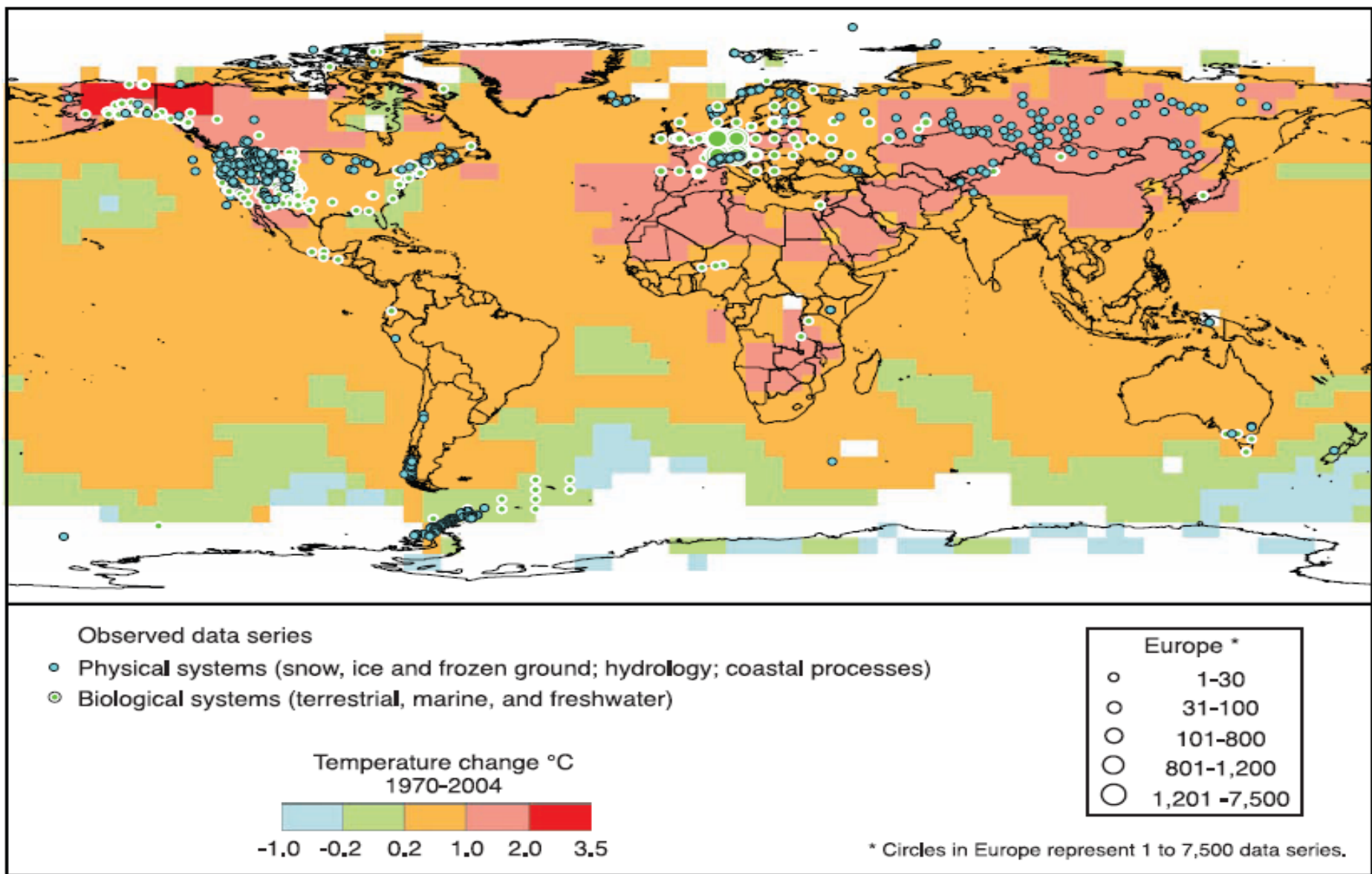
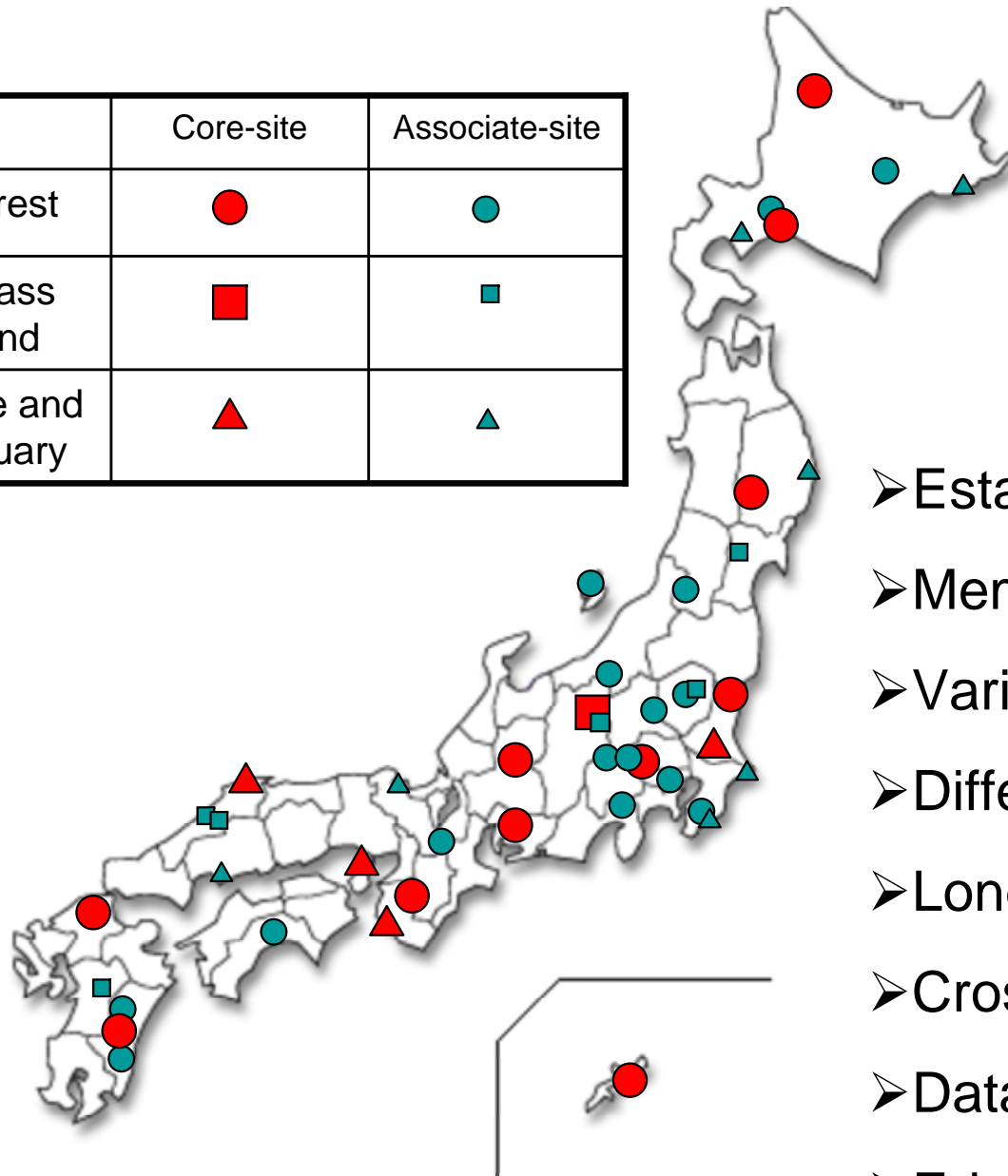


Figure 1.8. Locations of significant changes in observations of physical systems (snow, ice and frozen ground; hydrology; coastal processes) and biological systems (terrestrial, marine and freshwater biological systems), are shown together with surface air temperature changes over the period 1970 to 2004 (from the GHCN-ERSST dataset). The data series met the following criteria: (1) ending in 1990 or later; (2) spanning a period of at least 20 years; (3) showing a significant change in either direction, as assessed by individual studies. White areas do not contain sufficient observational climate data to estimate a temperature trend.

Japan Long-Term Ecological Research Network (JaLTER)

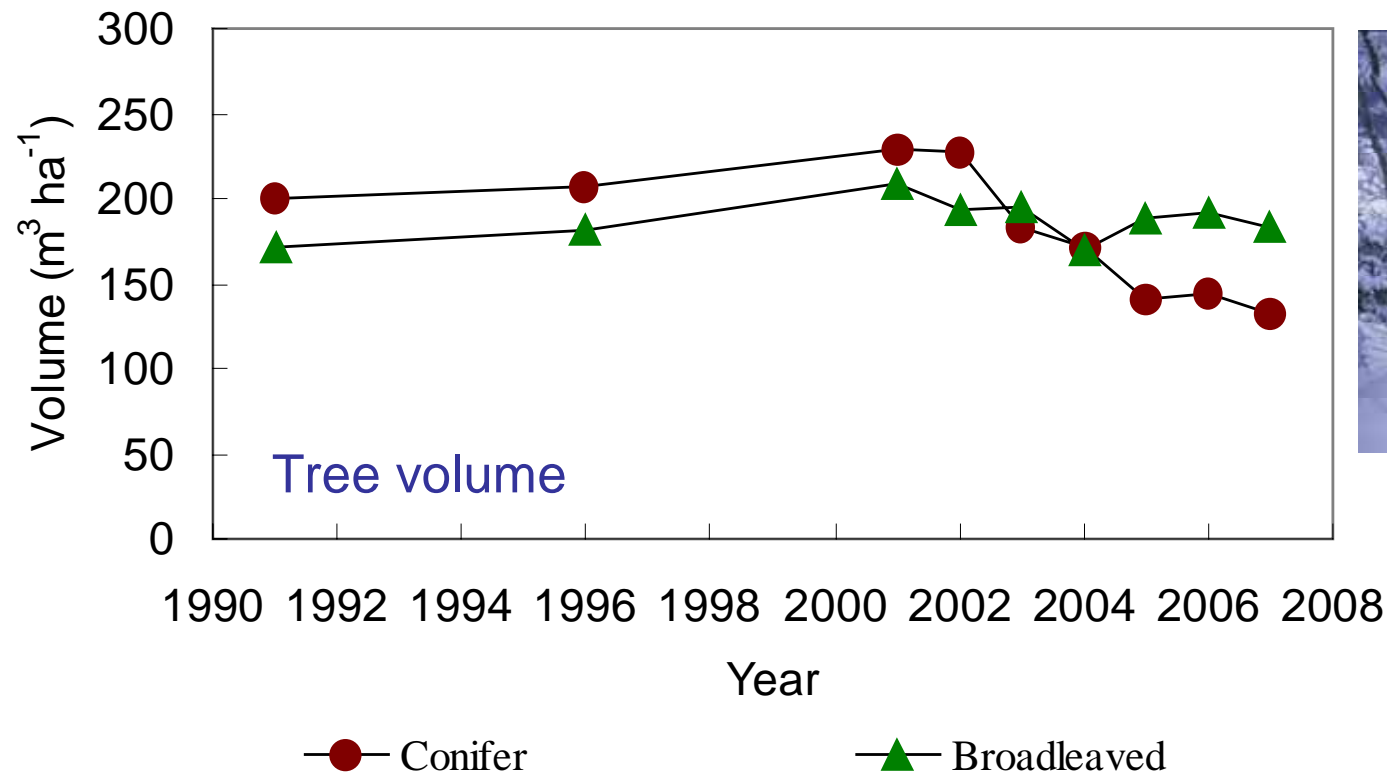
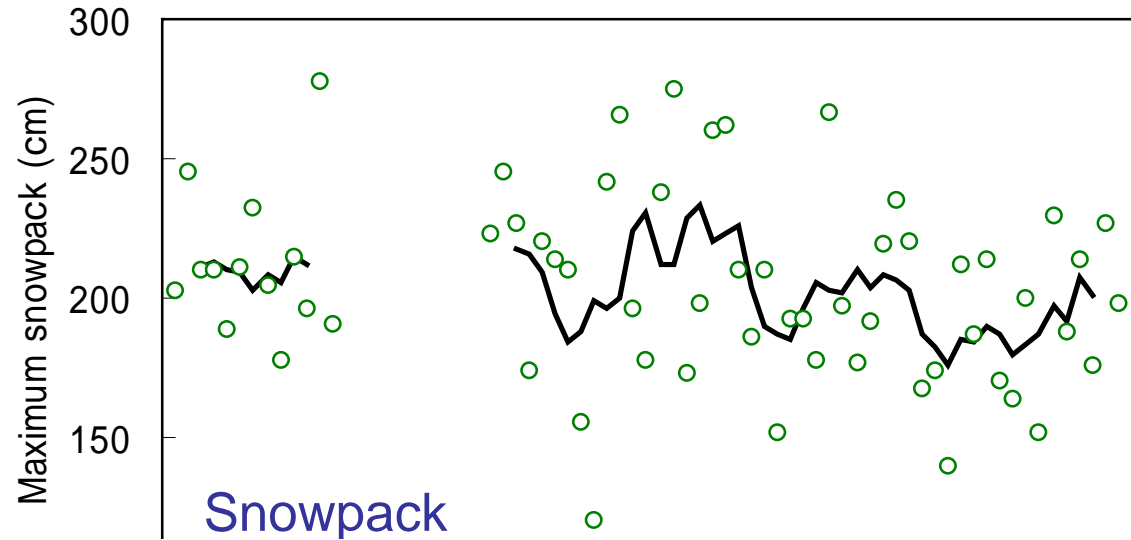
	Core-site	Associate-site
Forest	●	●
Grass land	■	■
Lake and estuary	▲	▲



JaLTER site network (April 2008)

- Established in 2006
- Membership of ILTER in 2007
- Various ecosystems and institutes
- Different environmental conditions
- Long-term and Large-scale study
- Cross-site analysis
- Data archive and sharing
- Education program

Challenge of JaLTER; Long-term monitoring of environment and ecosystem



Natural mixed forest

Challenge of JaLTER: Large-scale infrastructures



Challenge of JaLTER: Integrated study of ecosystem processes

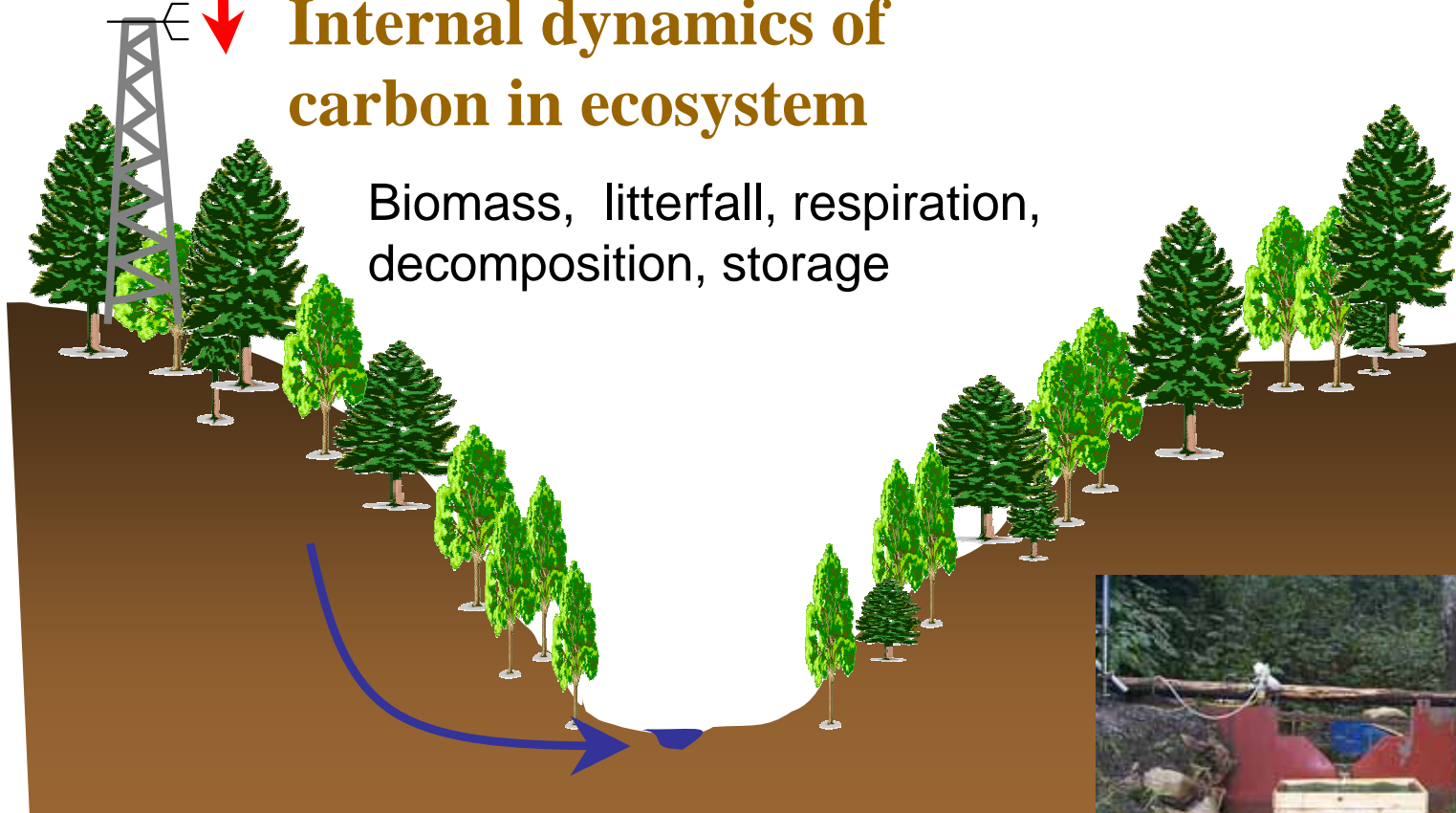
-- carbon cycling in watershed ecosystem --



Carbon exchange between ecosystem and atmosphere

Internal dynamics of carbon in ecosystem

Biomass, litterfall, respiration, decomposition, storage

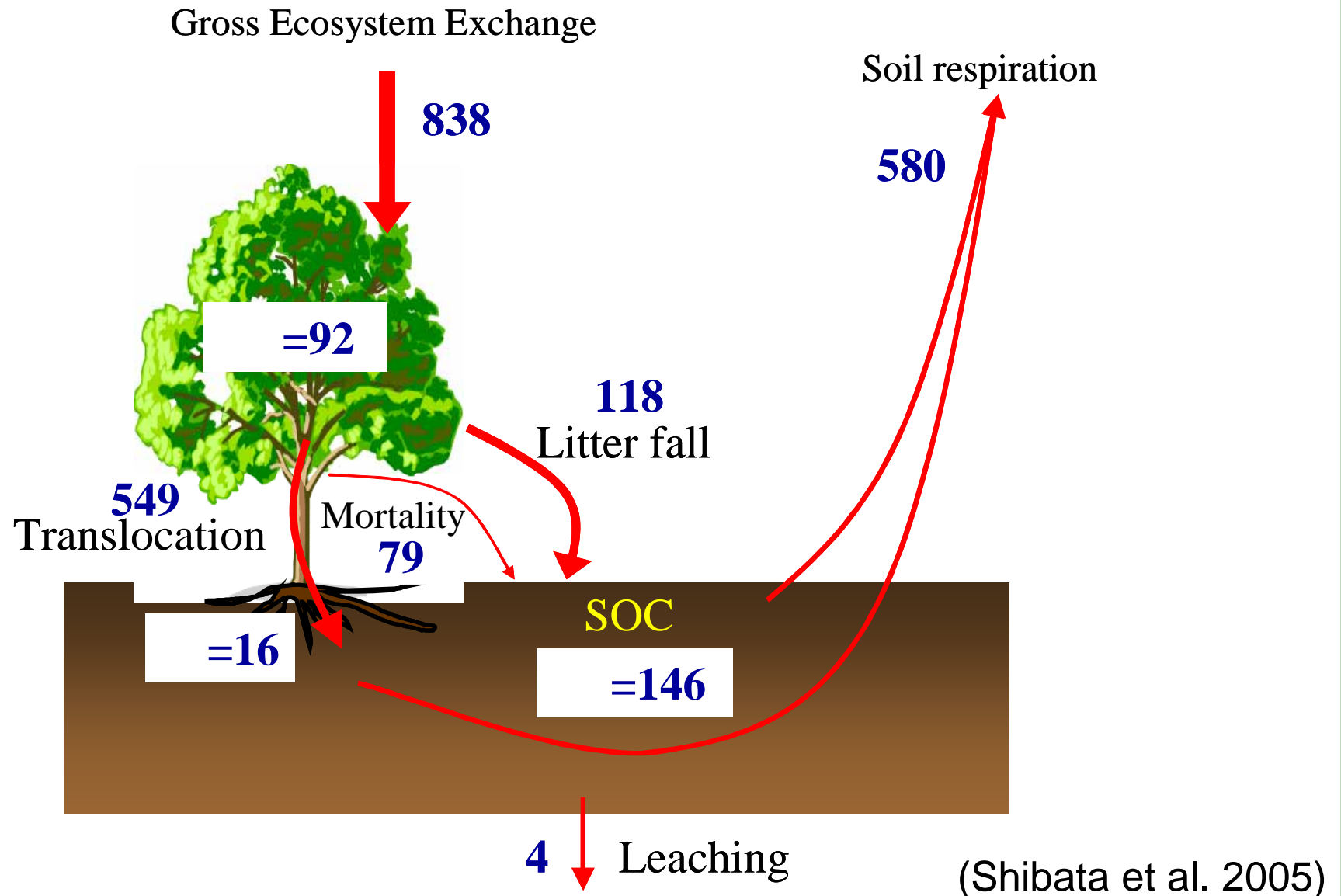


Carbon leaching to stream



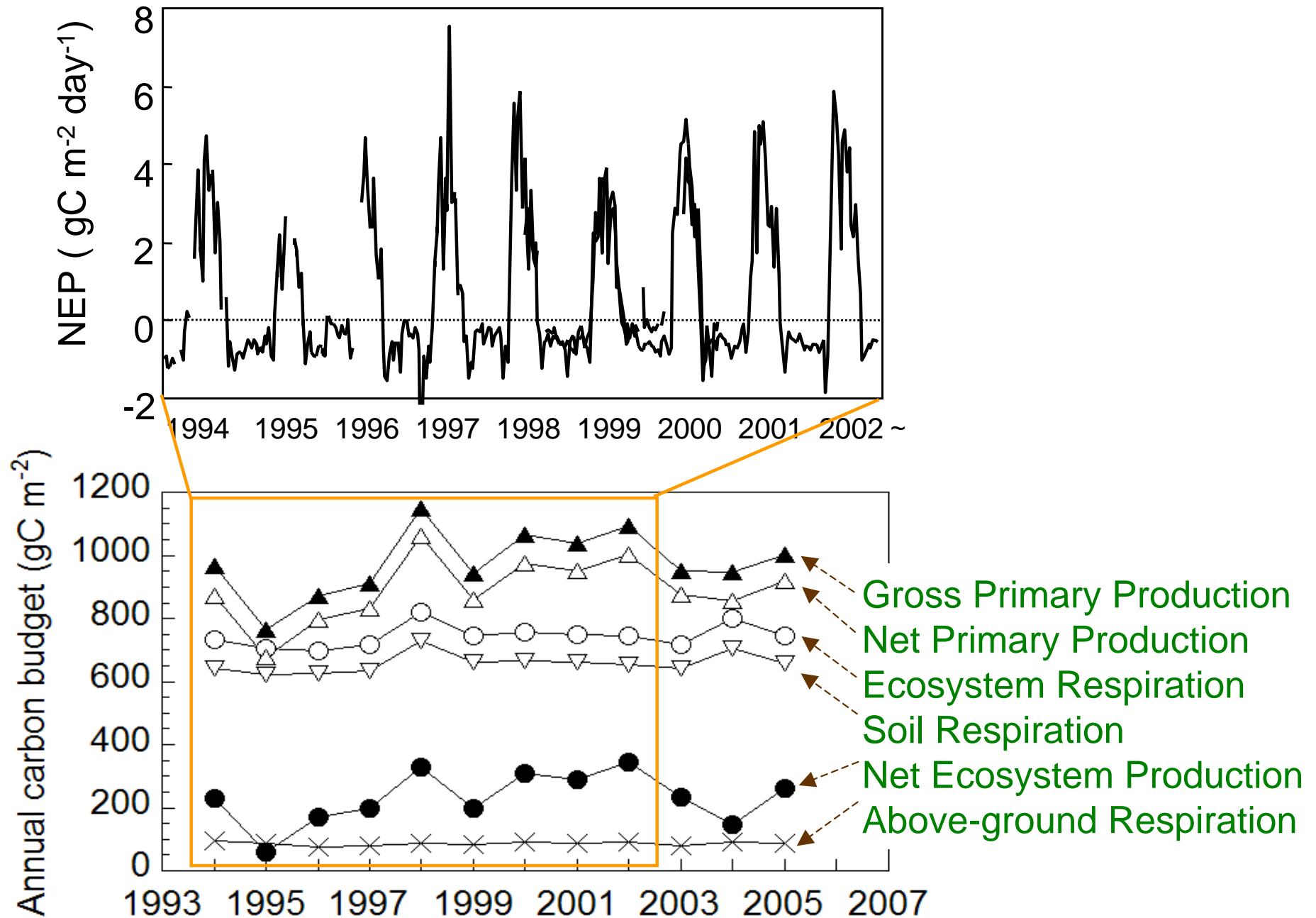
Challenge of JaLTER: Integrated study of ecosystem processes

IGBP/MEXT·GCTE project (JaLTER core-site; Tomakomai)



Carbon cycling and budget in forest ecosystem ($\text{gC m}^{-2} \text{y}^{-1}$)

Challenge of JaLTER: Long-term study of ecosystem processes



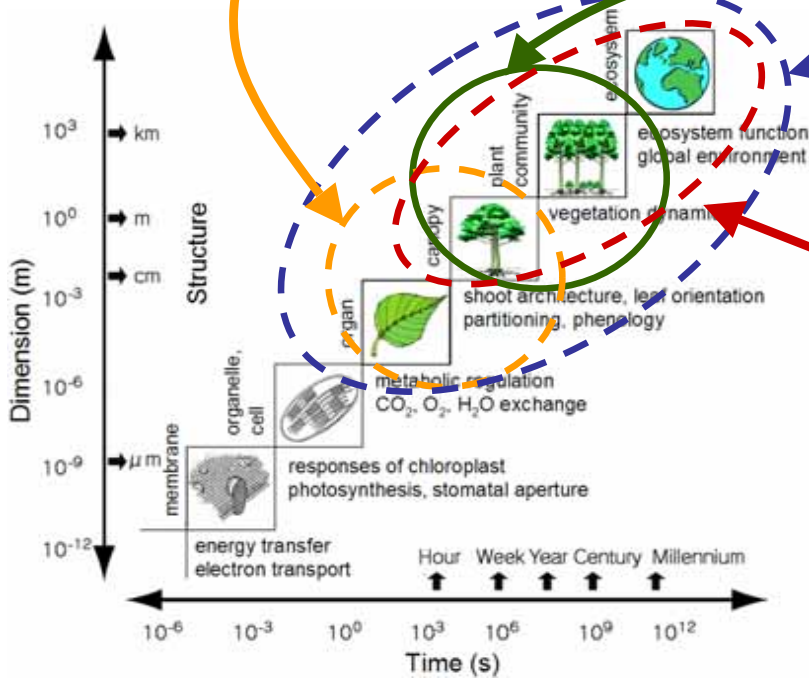
JaLTER core-site; Takayama (provided by Dr. Muraoka (Gifu Univ.))

Challenge of JaLTER: Interdisciplinary approach

Ecosystem process

Flux measurement

Process model



Remote sensing

JaLTER core-site; Takayama (provided by Dr. Muraoka (Gifu Univ.))

Challenge of JaLTER: Application of experimental manipulation



Nitrogen addition



Soil warming experiment



Clear-cut experiment

Challenge of JaLTER: Interdisciplinary cross-site study



--- Monitoring sites 1000 ---
Ministry of Environment, Japan

- ✓ Biodiversity & Ecosystem
- ✓ Tree growth
- ✓ Litter-fall
- ✓ Seed production
- ✓ Forest-floor insects
- ✓ Bird community

Forest and estuary sites are strongly over-lapped by JaLTER-site.

Challenge of JaLTER: Interdisciplinary cross-site study II

Collaboration with JapanFlux

AsiaFlux Website

Welcome to AsiaFlux

AsiaFlux is a regional research network bringing together scientists from university and institution in Asia to study the exchanges of carbon dioxide, water vapor, and energy between terrestrial ecosystems and the atmosphere across daily to inter-annual time scales.

Global Network	FLUXNET		
Regional Network	AsiaFlux	EuroFlux, AmeriFlux, OzFlux etc.	
Country Level Network	JapanFlux	KoFlux	Chinese Communities
Local Networks and Individual Sites, in Each Country			

Some JapanFlux sites are registered as JaLTER site.

Challenge of JaLTER: Data archiving and sharing – EML database

JaLTER Data Catalog Search

[Home](#) [Japanese skin](#)

search for data

All data on this server is "public". You may search and access to the data catalog without logged-in. Enter a search phrase (e.g. biodiversity) to search for data sets in the data catalog, or simply browse by category using the links below.

Search Data Catalog

» advanced search «

Taxonomy

Plant, Invertebrate, Mammal, Bird, Reptile, Amphibian, Fungi, Microbe, Virus

Habitat

Alpine, Aquatic, Beach, Benthic, Desert, Estuary, Forest, Grassland, Marine, Montane, Oceanic, Savanna, Shrubland, Terrestrial, Tundra, Urban, Wetland

File Edit Search Documentation Data Window Help

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Accession Number: malta.3.1 Keywords: testdata

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net

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Data Set Description

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Organization: The University of Tokyo
Position: FD
Associated Party:
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Position: FD
Abstract:
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● testdata

License and Usage Rights: testdata

Access Control:
Auth System: lcnb
Order: denyfirst
Access Rules:
ALLOW: [read] public
Contact:

Data Package: hshbata.16.1

File Edit Search Documentation Data Window Help

Associate Prof. Hirotaka Shikata: 1887_stream_chemistry_1996-1997
Accession Number: hshbata.16.1 Keywords: Stream chemistry, Forest basin, Biogeochemistry, Water quality

EMML

test	test	date	type	total number	total area (1 km ² or EC)	rep	total milligramPerCubic milligramPerCubic
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Field Deleted: DeletedDuplicate

Number Of Records: 26



Education program for next generation



Conclusive remark

- Linkage between GEOSS and on-site ecosystem research network with interdisciplinary approach would be quite important for ecosystem management toward the adaptation under global changes.
- Understandings of the interrelationship between carbon, water, nutrition and biodiversity in ecosystem with different environmental conditions and different spatial and temporal scale would be one of the key research themes for GEOSS-Ecosystem and Biodiversity.

We thank JaLTER and ILTER colleagues.



Kick-off meeting of JaLTER in Tomakomai Experimental Forest (November 2006)