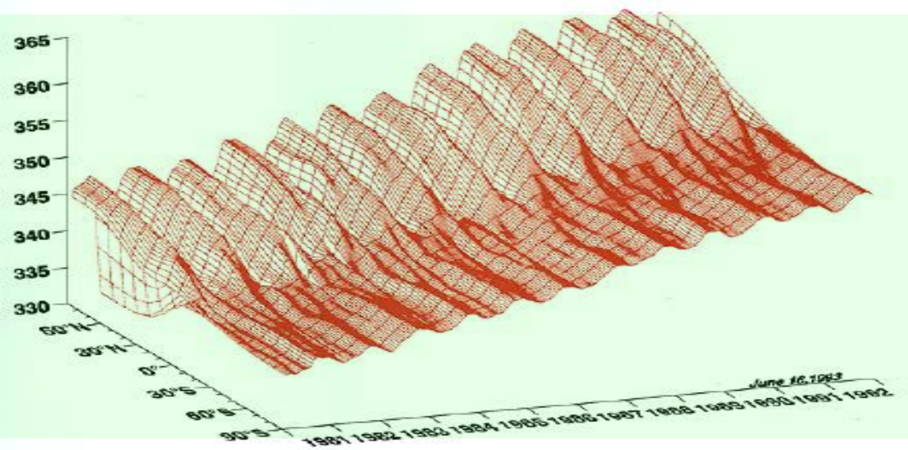
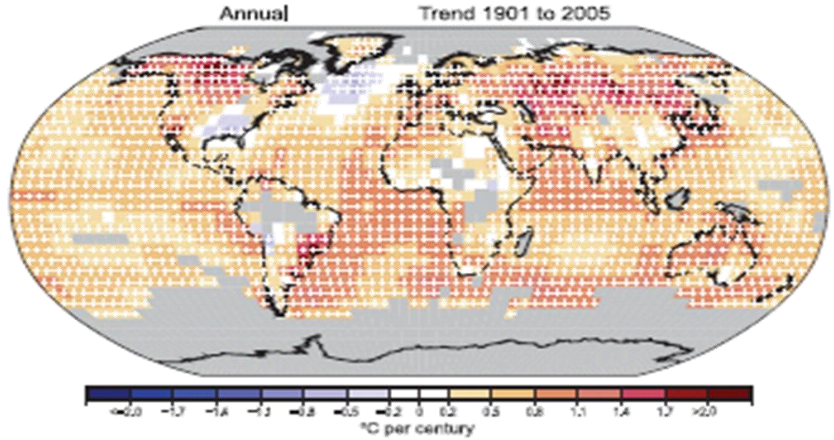
Cooperation history between LSCE and PKU

Shilong Piao & Phillipe Ciais

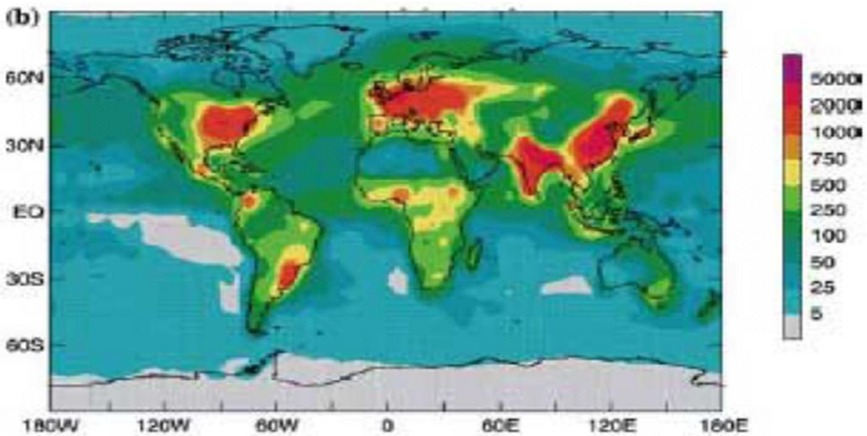
Changes in climate and atmospheric components

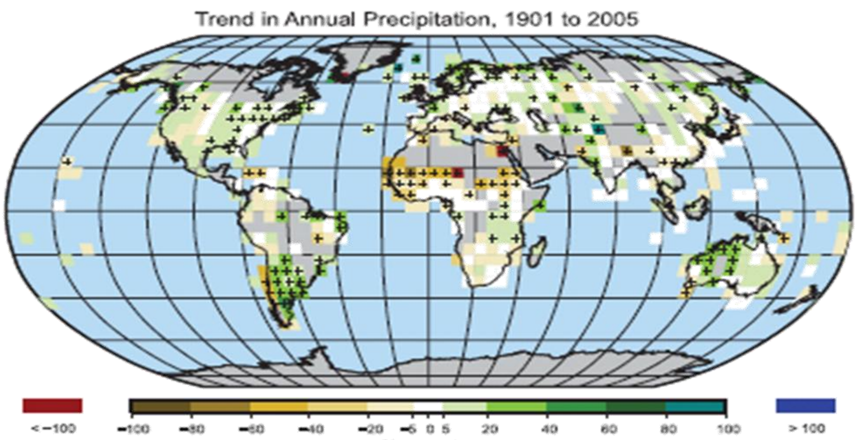


CO2 increase



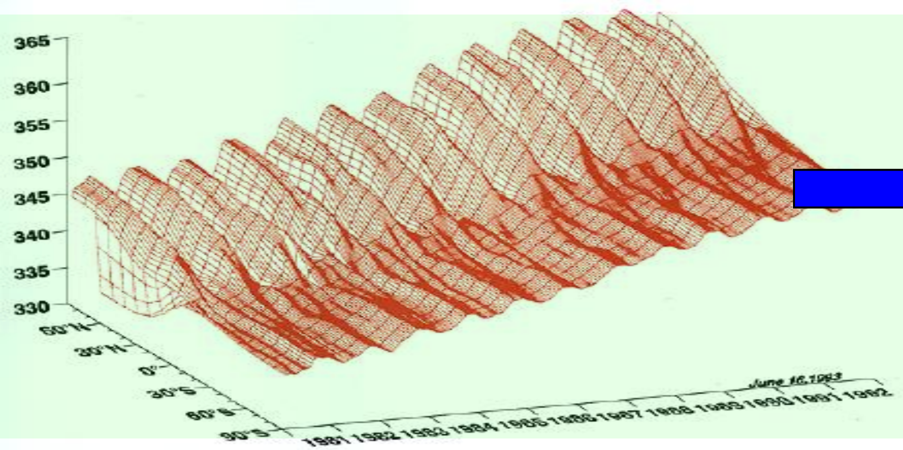
Temperature change



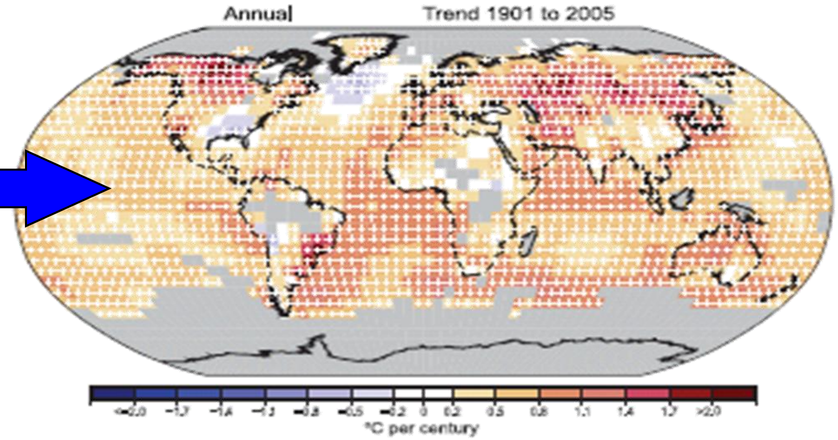


Nitrogen deposition *Precipitation change*

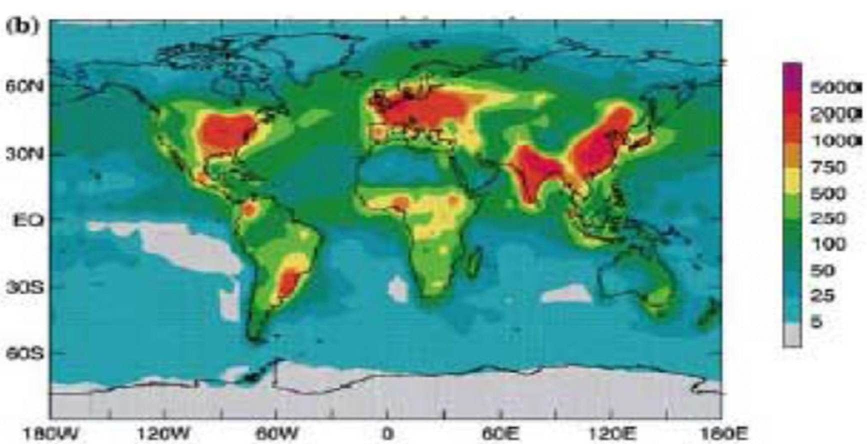
Atmospheric Scientists have established:



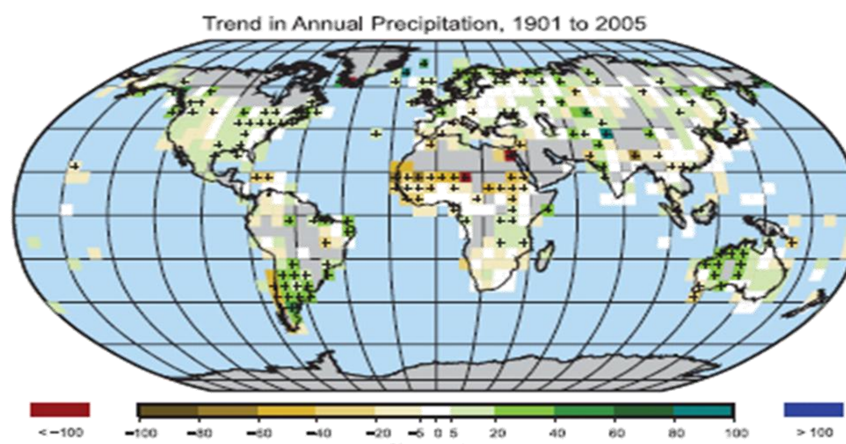
CO2 increase



Temperature change

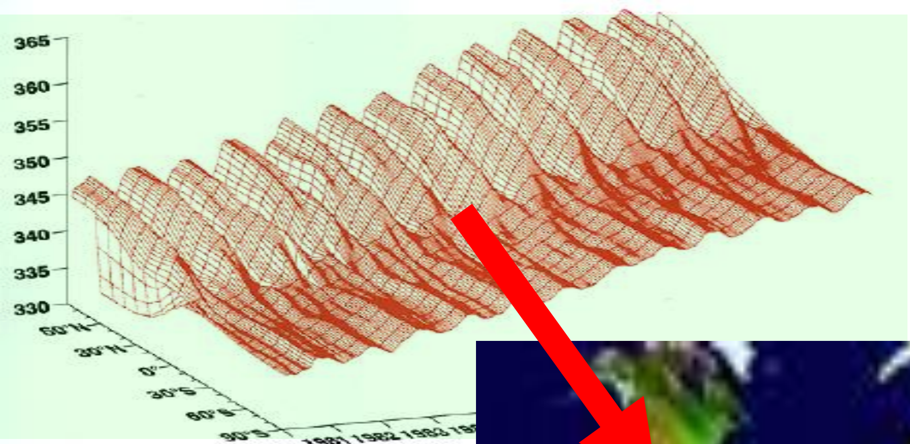


Nitrogen deposition

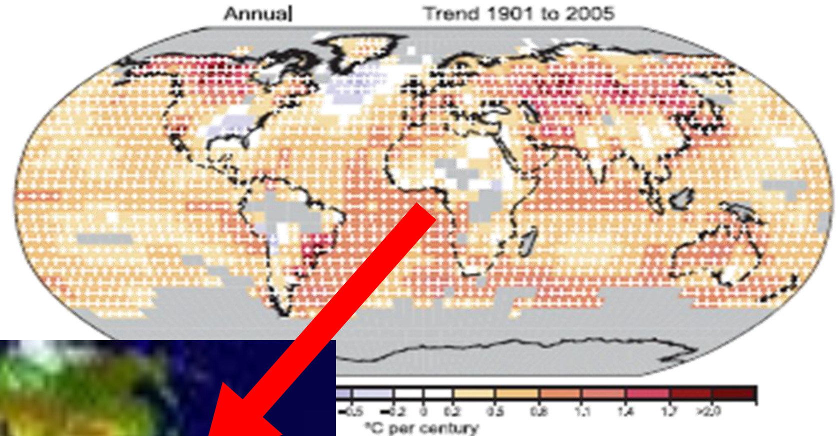


Precipitation change

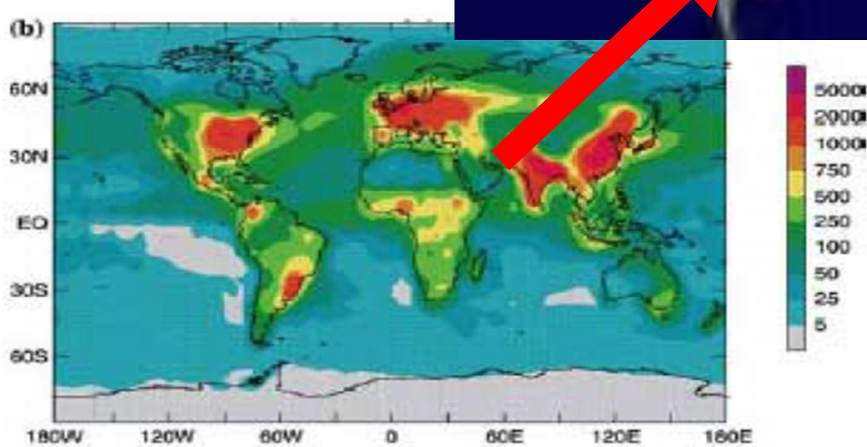
What aree the responses of terresrial ecosystem to these changes?

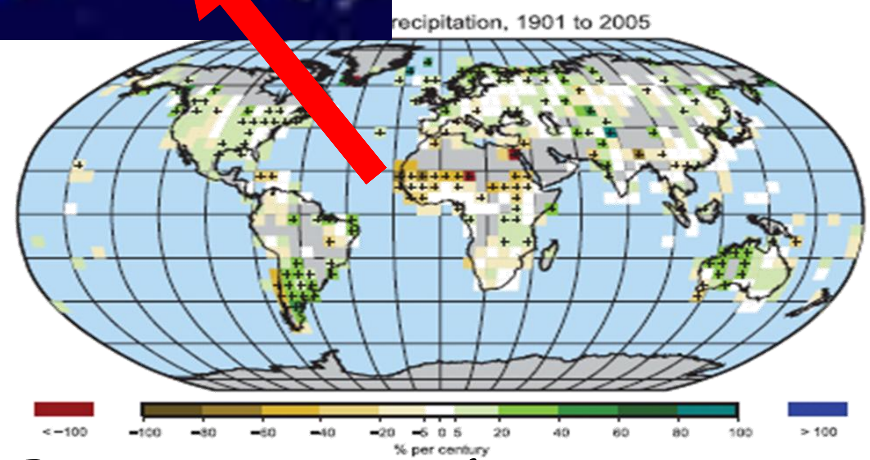


CO2 increase



...perature change





Nitrogen deposition *Precipitation change*

Present & Past Subjects (2004-)

- **The impacts of climate changes on vegetation productivity；**
- **Change in phenology and its effects on terrestrial carbon cycle；**
- **Global/regional carbon budget；**
- **The impacts of climate change on water resource。**

(1) The impact of climate change on vegetation productivity

- **Investigate the spatial patterns of change in vegetation growth and its mechanisms in the Northern Hemisphere**

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 108, NO. D14, 4401, doi:10.1029/2002JD002848, 2003

Interannual variations of monthly and seasonal normalized difference vegetatio

Shilong Piao,[1] Jingyun Fan
Yan Li,[1] and Shu Tao[1]

Received 15 August 2002; revised 2

[1] In this paper, we analy index (NDVI) and their rel precipitation) and human ac NDVI increased significant period. NDVI shows the la 0.0018 yr^{-1}) over 85.9% o (5.2% with a trend of 0.00 show a marked heterogene climates. There is about a temperature (February) and

Journal of Vegetation Science 15: 219-226, 2004
© IAVS; Opulus Press Uppsala

Var

Piao Shilong[1]**;**

[1]*Department of Ecology*
Ministry of Education, Pe
Kansas City, 5100 Rockh
Science, Policy and Mana
[4]*Department of Resource*
Process
Corr

GLOBAL BIOGEOCHEMICAL CYCLES, VOL. 19, GB2027, doi:10.1029/2004GB002274, 2005

Changes in vege 1982 to 1999 in

Shilong Piao,[1,2] Jingy
and Shu Tao[4]

Received 31 March 2004; rev

[1] Terrestrial net pri science in the past sev and ecosystem proces the northern middle a exhibited seasonal an

GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L06402, doi:10.1029/2004GL021764, 2005

NDVI-indica two decades

Shilong Piao, Ji
Department of Ecology
of Education, Peking U

Received 15 October 2

[1] In this study, China from 1982 area and normaliz arid and semiarid and climatic varia

GEOPHYSICAL RESEARCH LETTERS, VOL. 33, LXXXXX, doi:10.1029/2006GL028205, 2006

Effect of climate and CO_2 changes on the greening of the Northern Hemisphere over the past two decades

Shilong Piao,[1] Pierre Friedlingstein,[1] Philippe Ciais,[1] Liming Zhou,[2] and Anping Chen[3]

Received 18 September 20

[1] Study of the ef vegetation growth, an understanding of th ecosystems and clima spatial patterns of veg variability over North 2000 using a mecha

PNAS

Spring temperature change and its implication in the change of vegetation growth in North America from 1982 to 2006

Xuhui Wang[a], Shilong Piao[a,1], Philippe Ciais[b], Junsheng Li[c,1], Pierre Friedlingstein[b,d], Charlie Koven[e], and Anping Chen[f]

[a]Department of Ecology, College of Urban and Environmental Science, Peking University, Beijing 100871, China; [b]Laboratoire des Sciences du Climat et de l'Environnement, Unité Mixte de Recherche Commissariat à l'Energie Atomique–Centre National de la Recherche Scientifique–Université de Versailles Saint-Quentin-en-Yvelines, Batiment 709, CE L'Orme des Merisiers, Gif-sur-Yvette, F-91191, France; [c]Chinese Research Academy of Environmental Sciences, Beijing 100012, China; [d]Quantifying and Understanding the Earth System (QUEST), Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, United Kingdom; [e]Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720; and [f]Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544

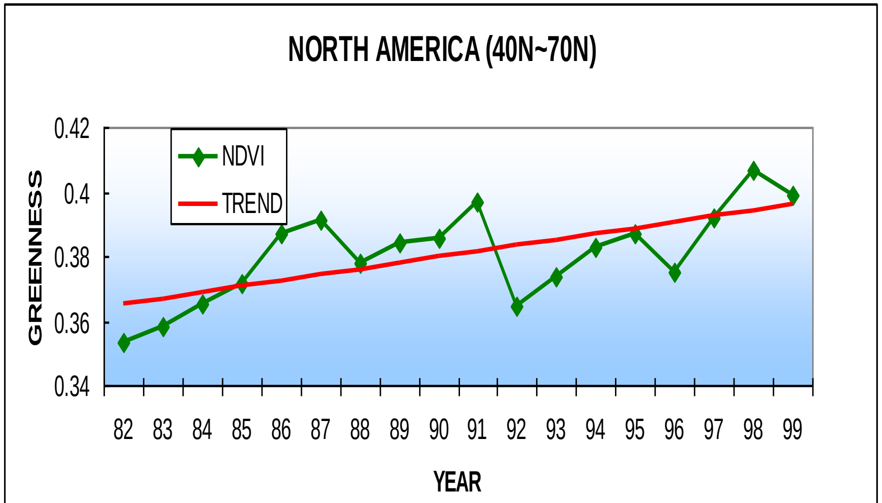
Edited by Robert E. Dickinson, University of Texas at Austin, Austin, TX, and approved December 6, 2010 (received for review September 27, 2010)

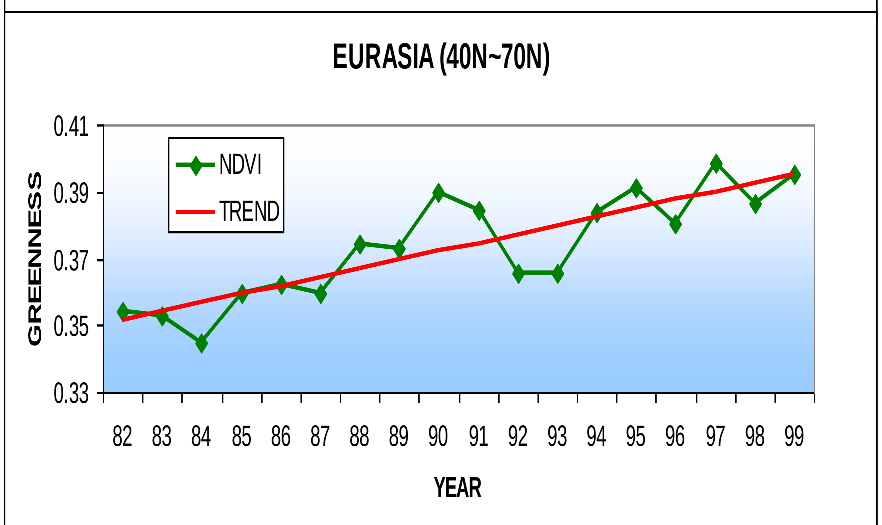
Understanding how vegetation growth responds to climate change is a critical requirement for projecting future ecosystem dynamics. Parts of North America (NA) have experienced a spring cooling

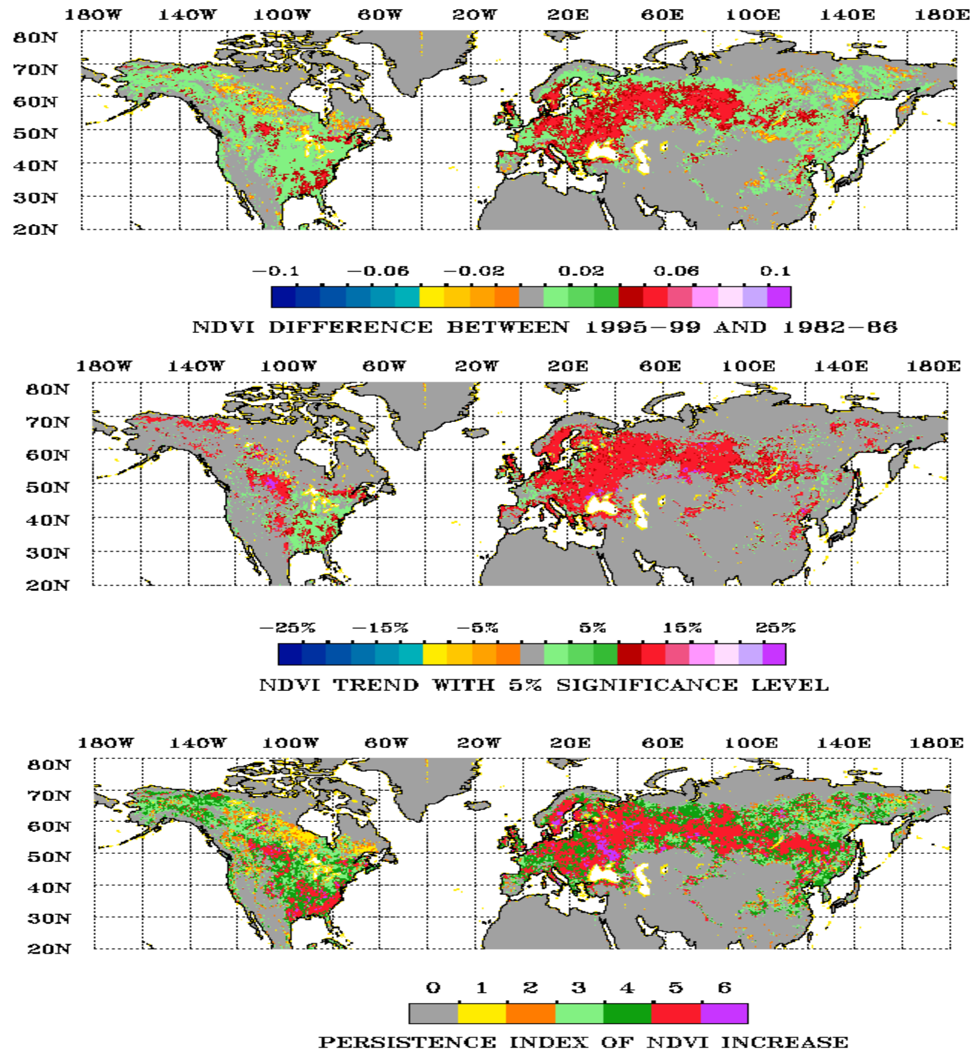
temperature has risen by 1.1 °C since the 1980s (16). Warmer spring temperature will generally enhance vegetation productivity by extending the growing season. Rather than responding to

(1) The impact of climate change on vegetation productivity

Enhanced vegetation growth







Zhou et al. (2001)

(1) The impact of climate change on vegetation productivity

Zhou et al. (2001)

detrending the original time series. To estimate the relation between NDVI and temperature, we estimate the regression model

$$Y = \beta_0 + \beta_1 X + \beta_2 \text{time} + \varepsilon, \qquad (11)$$

where Y is the dependent variable, time is the deterministic variable, X is the independent variable, β_0, β_1 and β_2 are regression coefficients, and ε is a stochastic error term. This

Greening of NH was chiefly driven by rising temperature

Ahlbeck et al. (2002)

[2] To confirm Ahlbeck's results, we estimate the following equation:

$$\text{NDVI} = \beta_0 + \beta_1 \ \text{temp} + \beta_2 \text{CO}_2 + \varepsilon, \qquad (1)$$

with data from North America and Eurasia. Here temp denotes temperature. To determine whether CO_2 or temperature has a statistically measurable effect on NDVI, we use a t statistic to test the null hypothesis that the

Greening of NH was chiefly driven by rising atmospheric CO2

Mechanisms controlling current enhanced vegetation growth in the Northern Hemisphere are under debate!

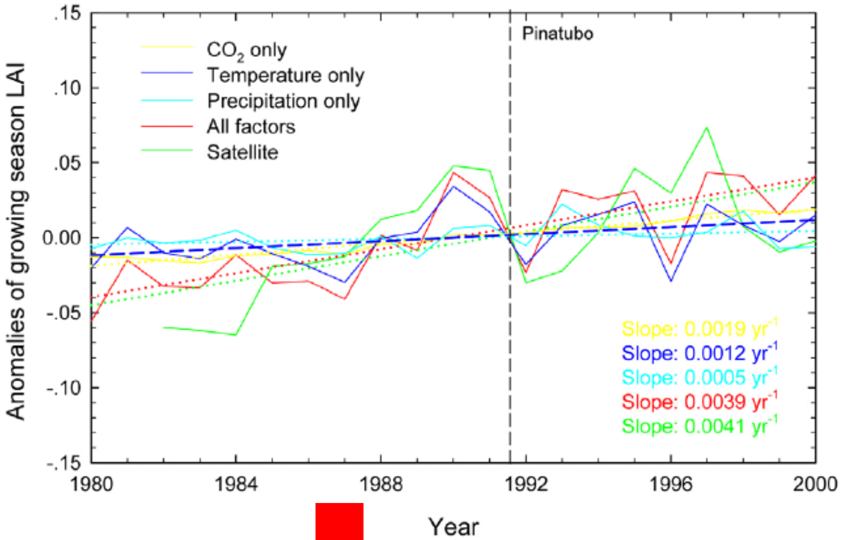
GEOPHYSICAL RESEARCH LETTERS, VOL. 33, LXXXXX, doi:10.1029/2006GL028205, 2006

(1) The impact of climate change on vegetation productivity

Effect of climate and CO_2 changes on the greening of the Northern Hemisphere over the past two decades

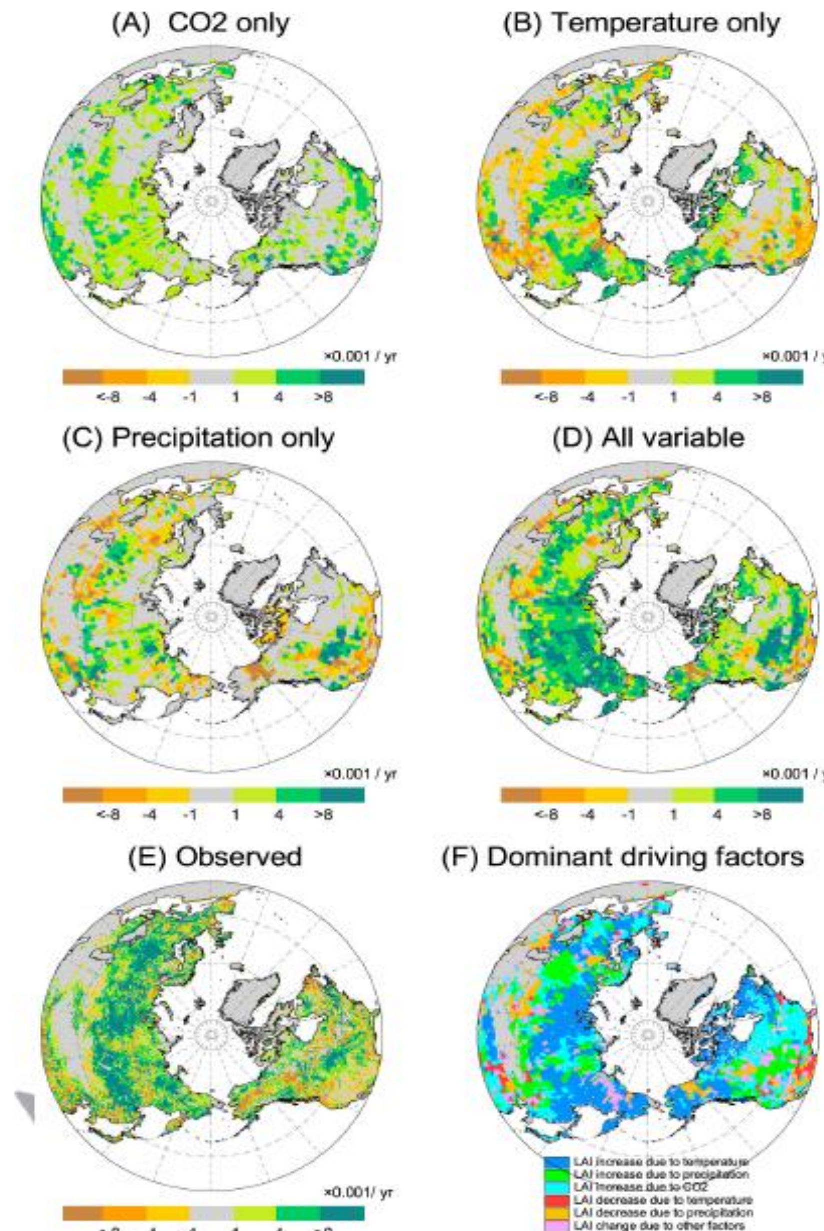
Shilong Piao,[1] Pierre Friedlingstein,[1] Philippe Ciais,[1] Liming Zhou,[2] and Anpin

Received 18 September 2006; revised 24 October 2006; accepted 27 October 2006; published XX Month 200



At the continental scale, Interannual variation was chiefly driven by temperature;

For the trend: rising atmospheric CO2 contributed by 49%; while temperature contributed by 31%.



Spring temperature change and its implication

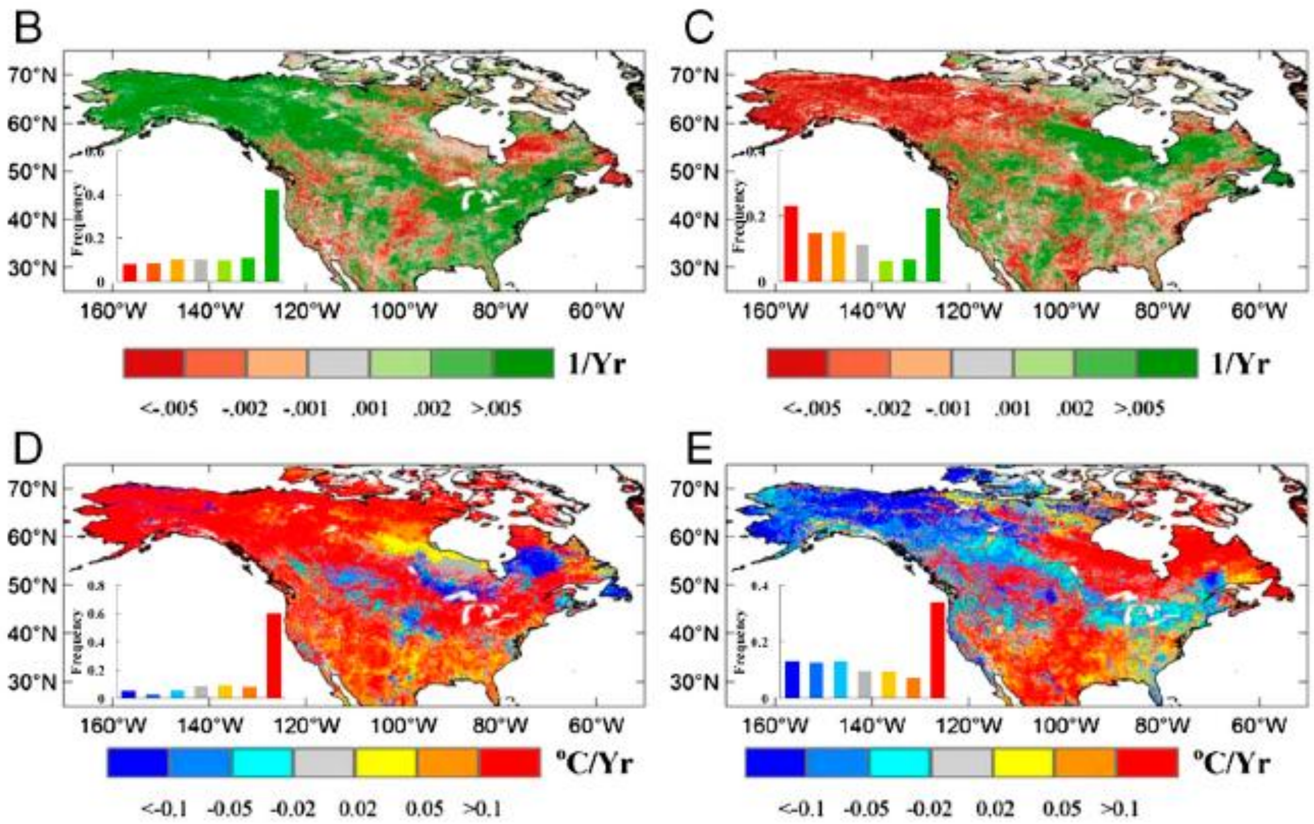
(1) The impact of climate change on vegetation productivity

Xuhui Wang[a], Shilong Piao[a,1], Philippe Ciais[b], Junsheng Li[c,1], Pierre Friedlingstein[b,d], Charlie Koven[e], and Anping Chen[f]

[a]Department of Ecology, College of Urban and Environmental Science, Peking University, Beijing 100871, China; [b]Laboratoire des Sciences du Climat et de l'Environnement, Unité Mixte de Recherche Commissariat à l'Energie Atomique–Centre National de la Recherche Scientifique–Université de Versailles Saint-Quentin-en-Yvelines, Batiment 709, CE L'Orme des Merisiers, Gif-sur-Yvette, F-91191, France; [c]Chinese Research Academy of Environmental Sciences, Beijing 100012, China; [d]Quantifying and Understanding the Earth System (QUEST), Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, United Kingdom; [e]Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720; and [f]Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544

Edited by Robert E. Dickinson, University of Texas at Austin, Austin, TX, and approved December 6, 2010 (received for review September 27, 2010)

Understanding how vegetation growth responds to climate change ... temperature has risen by 1.1 °C since the 1980s (16). Warmer



(2) Phenology change and its effects on terrestrial carbon cycle

- Investigate the links between the trends of phenological events and terrestrial carbon fluxes over NH

Global Change Biology (2006) 12, 672–6

Variations in satelli
temperate vegetatio

SHILONG PIAO*, JINGYUN F
*Department of Ecology, College of Environ
of Education, Peking University, Beijing 10
Technology, Atlanta, GA 30332, USA ‡LSC
France

Abstract

The relationship between
change research because
climate changes. In this
changes on growing seas
advanced very high resol
index (NDVI) biweekly ti
and concurrent mean temp
study period, the growing
region of China. The green
the dormancy delayed in
events are most significant
months. A warming in the

Click Here for Full Article

GLOBAL BIOGEOCHEMICAL CYCLES, VOL. 21, GB3018, doi:10.1029/2006GB002888, 2007

Growing season
the Northern He

Shilong Piao,[1] Pierre F
and Jérôme Demarty[1]

Received 9 November 2006; r

[1] A number of stud
significantly lengthene
variability and the terr
"ORganizing Carbon
based ecosystem mode
changes in phenology
(>25°N) during 1980–
increased by 0.30 days
onset in spring (0.16
Trends in the GSL are
significant trend towar
0.28 days yr^{-1} (R^2 =
delayed vegetation sen
period. Our results als
primary productivity (
growing seasons may
GSL leads to an increa
increase in NPP of 2.8
decomposition accomp

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

Influence of spring
transitions on fore

Andrew D. Richardson[1]
Nicolas Delbart[4], M
David Y. Hollinger[7], We
Sebastiaan Luyss
Leonardo Montagnani[12,1]
Shilong Piao[15], Corinn
Nobuko Saigusa[18], En
and

[1]Department of Organismic and Evolutiona
Harvard Uni
[3]Faculty of Land and Food Systems, Bi
Colum
[4]Laboratoire des Sciences du Clima
G
[5]Department of Geography and E
[6]Institute for Environmen

Vol 451 | 3 January 2008 | doi:10.1038/nature06444 nature

LETTERS

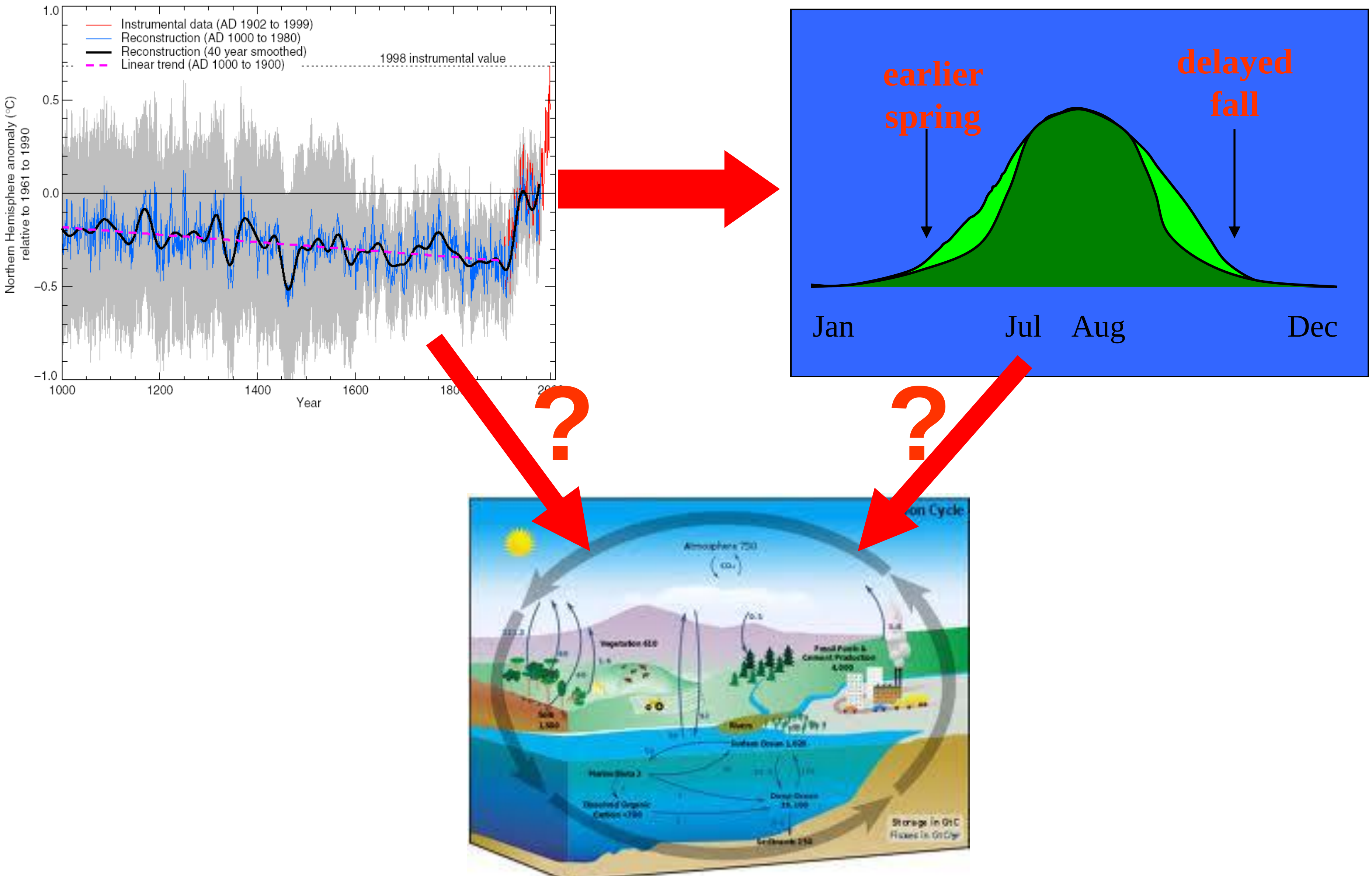
Net carbon dioxide losses of northern ecosystems in response to autumn warming

Shilong Piao[1], Philippe Ciais[1], Pierre Friedlingstein[1], Philippe Peylin[2], Markus Reichstein[3], Sebastiaan Luyssaert[4], Hank Margolis[5], Jingyun Fang[6], Alan Barr[7], Anping Chen[8], Achim Grelle[9], David Y. Hollinger[10], Tuomas Laurila[11], Anders Lindroth[12], Andrew D. Richardson[13] & Timo Vesala[14]

The carbon balance of terrestrial ecosystems is particularly sensitive to climatic changes in autumn and spring[1–4], with spring and autumn temperatures over northern latitudes having risen by about 1.1 °C and 0.8 °C, respectively, over the past two decades[5]. A simultaneous greening trend has also been observed, characterized by a longer growing season and greater photosynthetic activity[6,7]. These observations have led to speculation that spring and autumn warming could enhance carbon sequestration and extend the period of net carbon uptake in the future[8]. Here we analyse interannual variations in atmospheric carbon dioxide concentration data and ecosystem carbon dioxide fluxes. We find that atmospheric records from the past 20 years show a trend towards an earlier autumn-to-winter carbon dioxide build-up, suggesting a shorter net carbon uptake period. This trend cannot be explained by changes in atmospheric transport alone and, together with the ecosystem flux data, suggest increasing carbon losses in autumn. We use a process-based terrestrial biosphere model and satellite process-oriented terrestrial biosphere model (ORCHIDEE)[16] is combined with an atmospheric transport model (LMDZt)[17] to quantify the processes through which autumn warming controls the carbon balance of ecosystems (see Methods).

The seasonal cycle of atmospheric CO_2 concentrations provides an integrated measure of the net land–atmosphere carbon exchange (net ecosystem productivity; NEP) and its temporal characteristics[18,19]. We analysed the ten atmospheric CO_2 measurement records from the NOAA–ESRL air-sampling network[20], which cover at least 15 years of data in the Northern Hemisphere (Fig. 1 and Supplementary Table 1). The upward zero-crossing date of CO_2 was determined as the day when the de-trended atmospheric CO_2 seasonal cycle crosses the zero line from negative to positive values (see Methods). This date occurs in autumn at northern high-latitude stations and in early winter at northern tropical stations (Supplementary Table 1). We found that variations in the CO_2 zero-crossing date are negatively correlated with anomalies in autumn air tempera-

(2) Phenology change and its effects on terrestrial carbon cycle



GLOBAL BIOGEOCHEMICAL CYCLES, VOL. 21, GB3018, doi:10.1029/2006GB002888, 2007

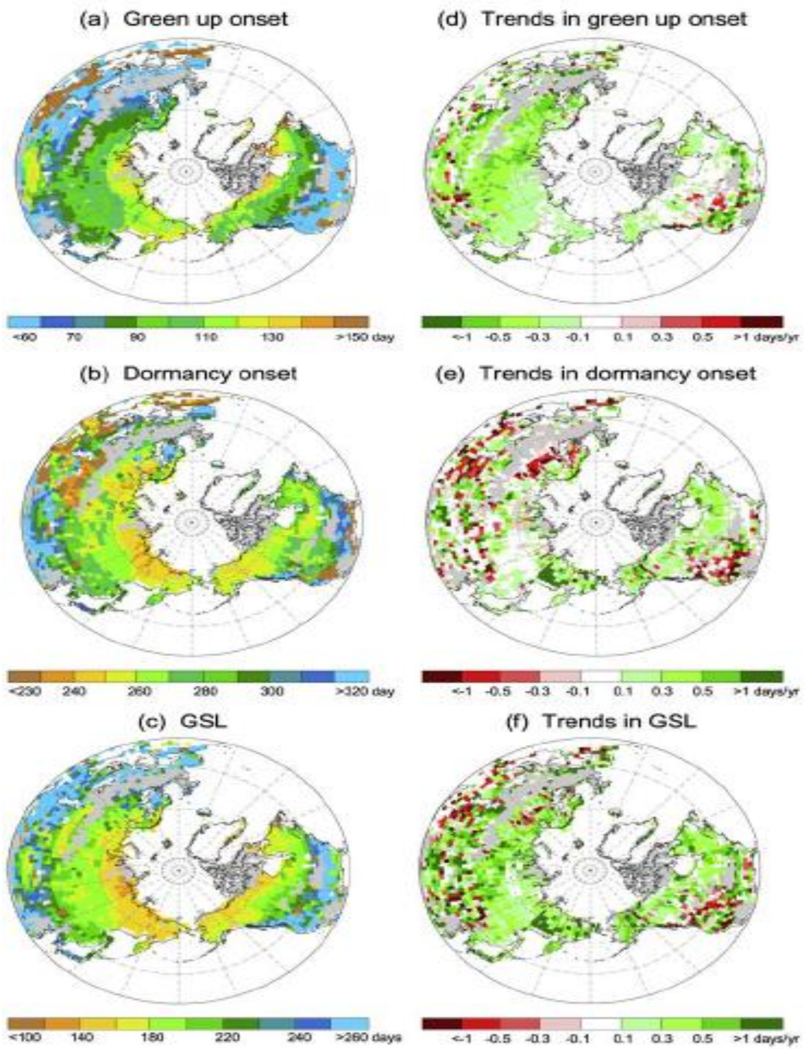
(2) Phenology change and its effects on terrestrial carbon cycle

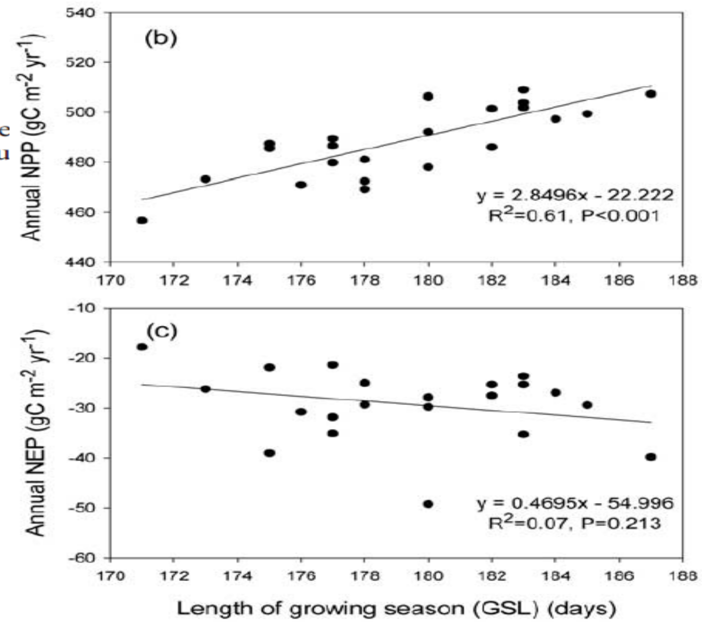
Gr
th

Shilong Piao,[1] Pierre Friedlingstein,[1] Philippe Ciais,[1] Nicolas Viovy,[1]
and Jérôme Demarty[1]

Received 9 November 2006; revised 29 May 2007; accepted 9 July 2007; published 25 September 2007.

[1] A number of studies have suggested that the growing season duration has significantly lengthened during the past decades, but the connections between phe variability and the terrestrial carbon (C) cycle are far from clear. In this study, we u





RESEARCH HIGHLIGHTS

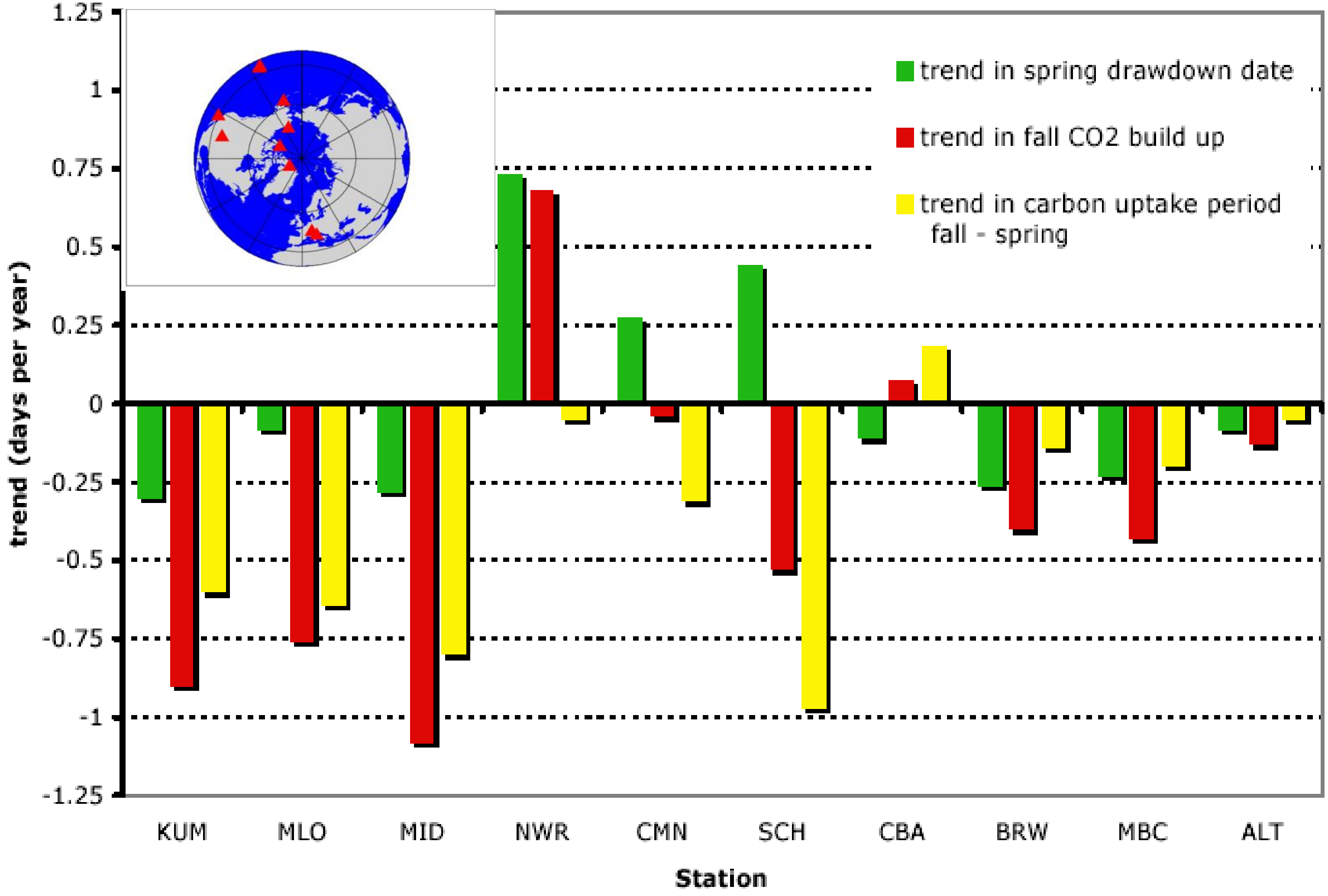
more dusty in summer, with important implications for central Asian climate.
Alicia Newton

Biodiversity and Ecology
Carbon balance

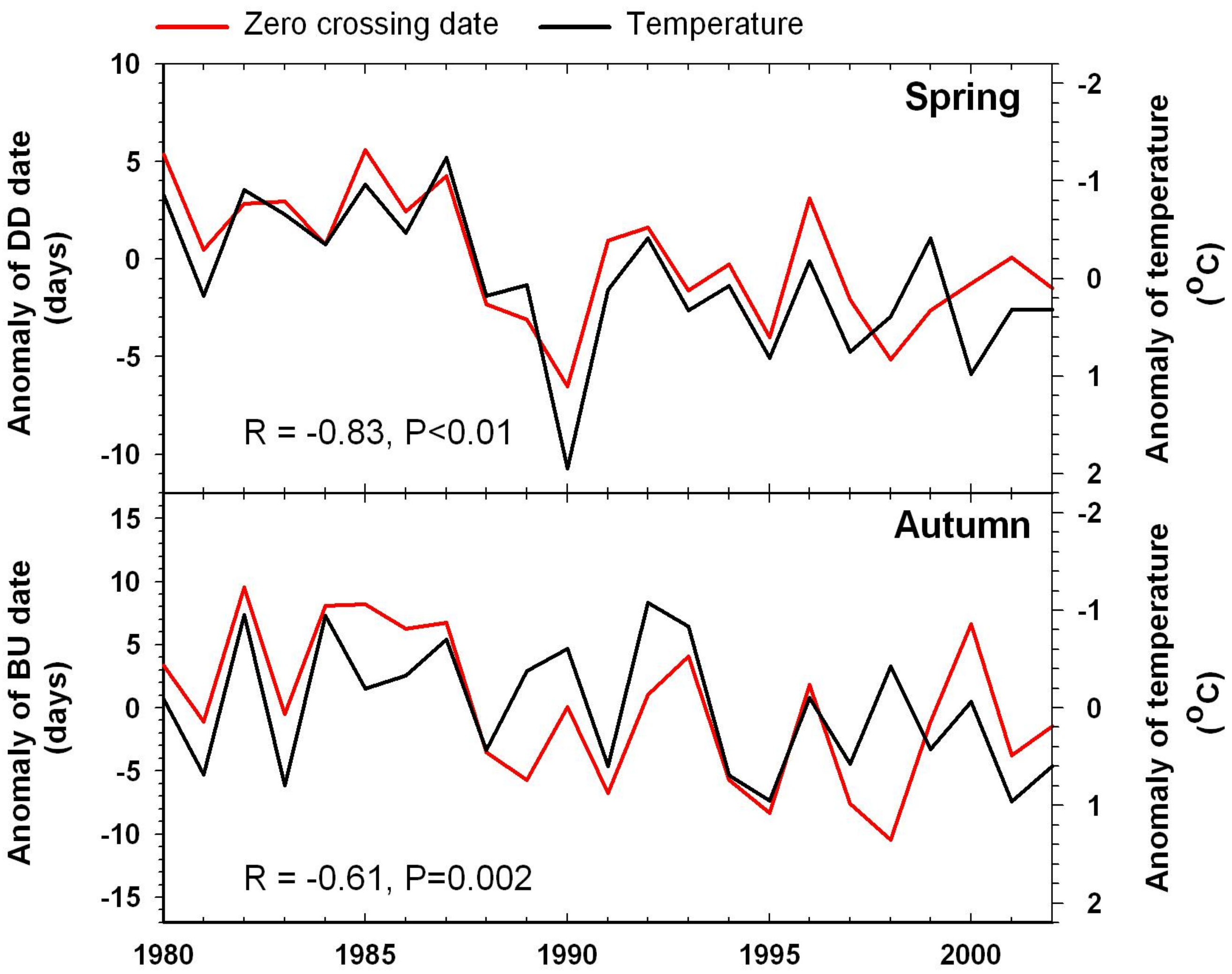
Global Biogeochem. Cy. 21, GB3018 (2007)
The growing season in the Northern Hemisphere has lengthened over the past few decades, but the atmospheric carbon dioxide mopped up by plant growth has been offset by a parallel rise in soil carbon decomposition, finds a new study.
Shilong Piao and colleagues from the Laboratoire des Sciences du Climat et de l'Environnement in Gif-sur-Yvette, France

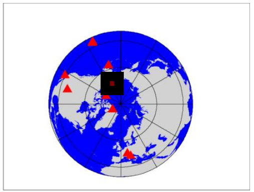
There are different responses of carbon cycle to the spring and autumn phenology

(2) Phenology change and its effects on terrestrial carbon cycle

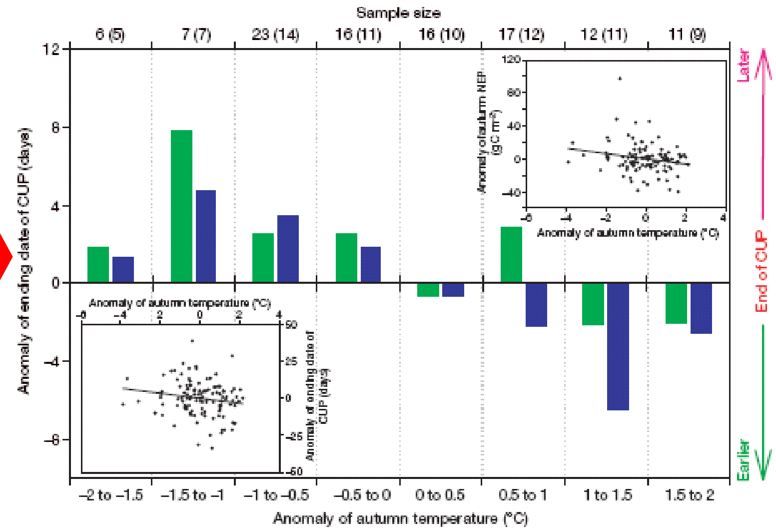


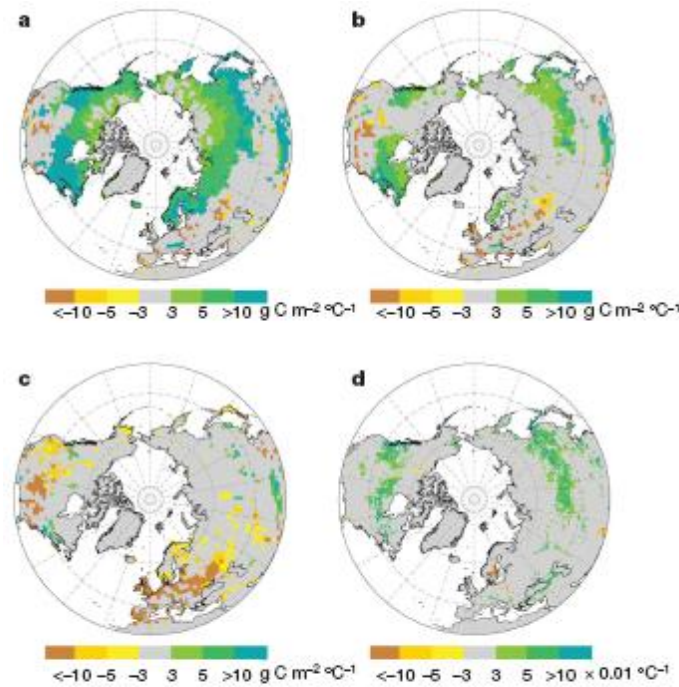
(2) Phenology change and its effects on terrestrial carbon cycle



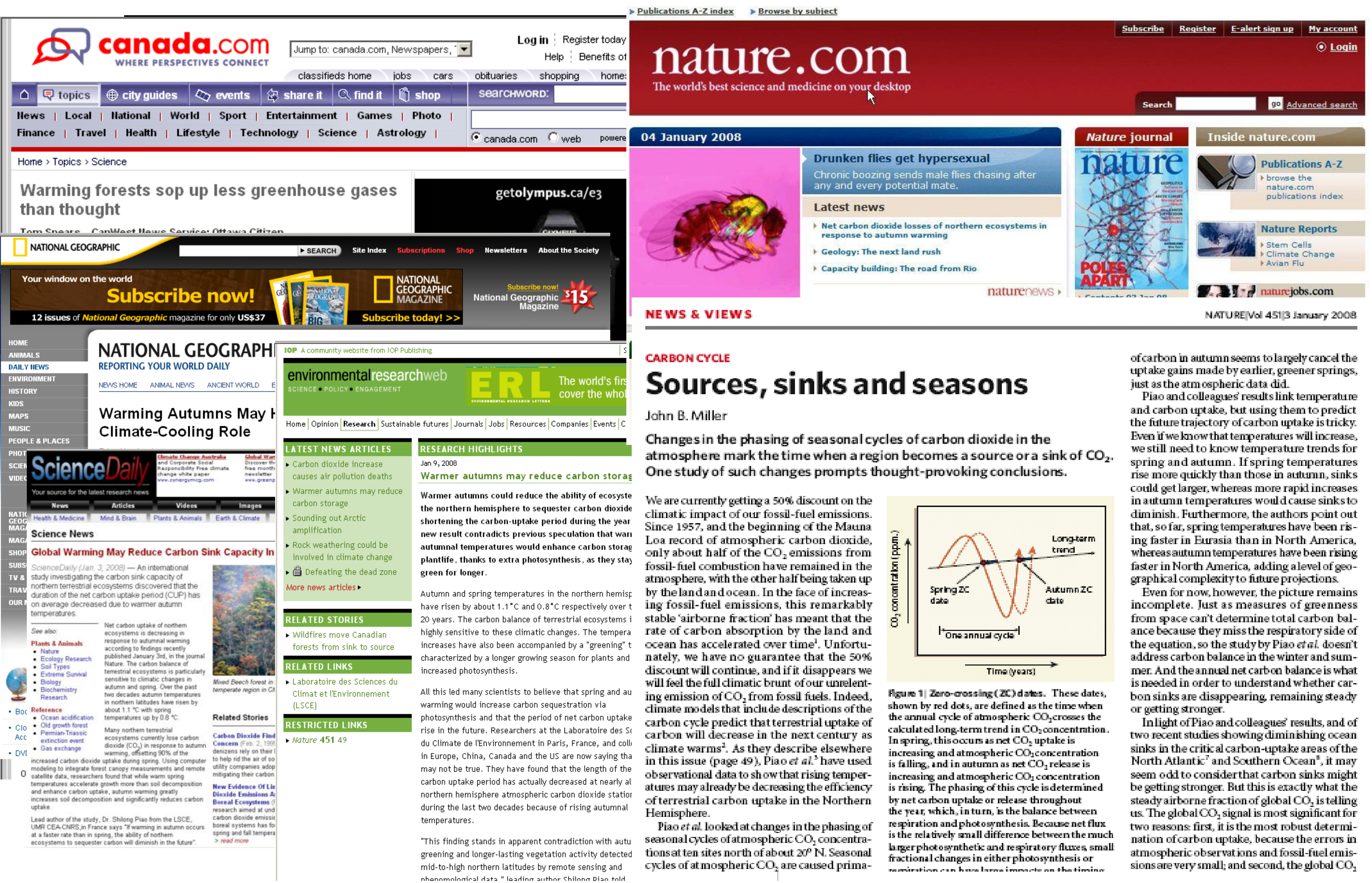


(2) Phenology change and its effects on terrestrial carbon cycle



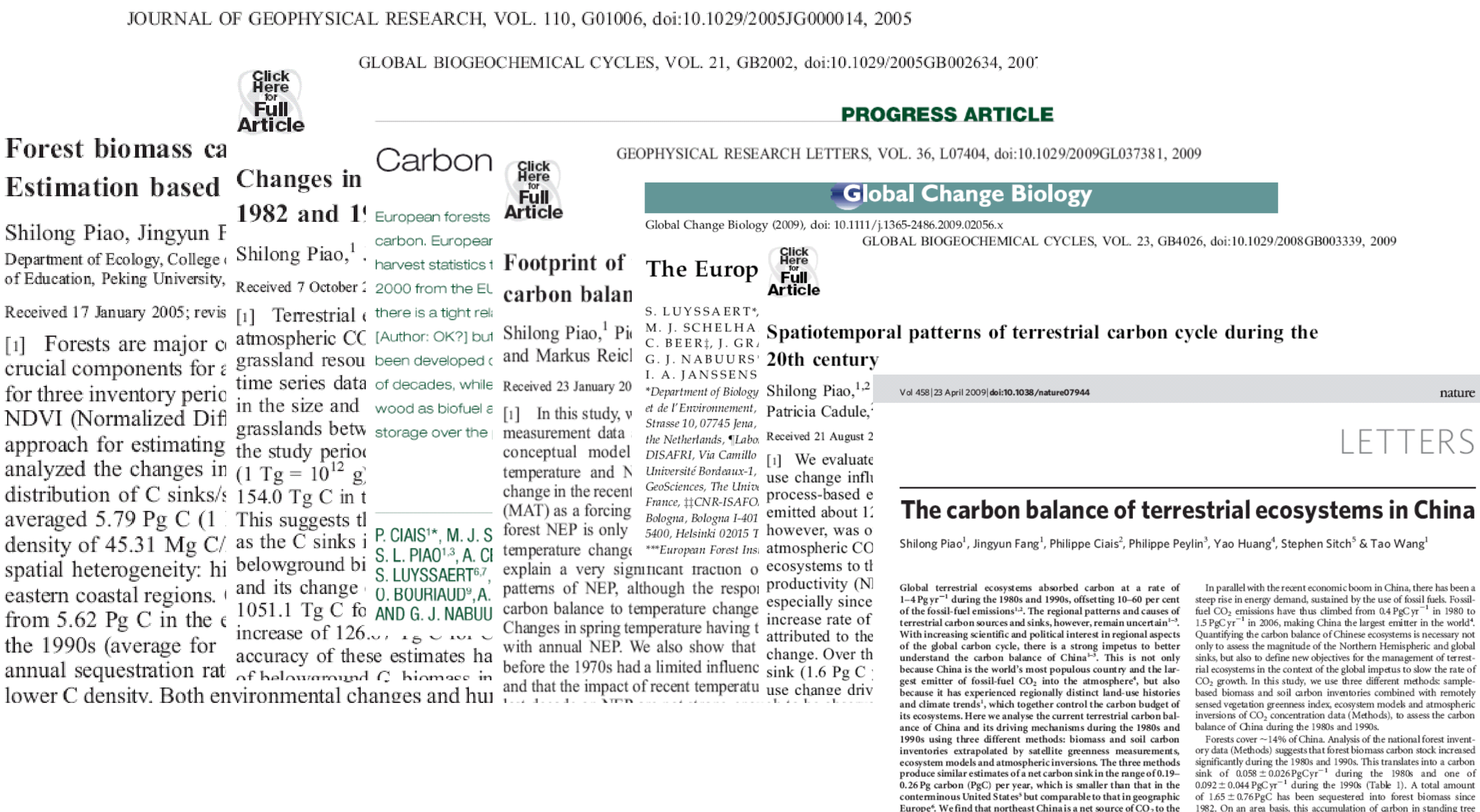


(2) Phenology change and its effects on terrestrial carbon cycle

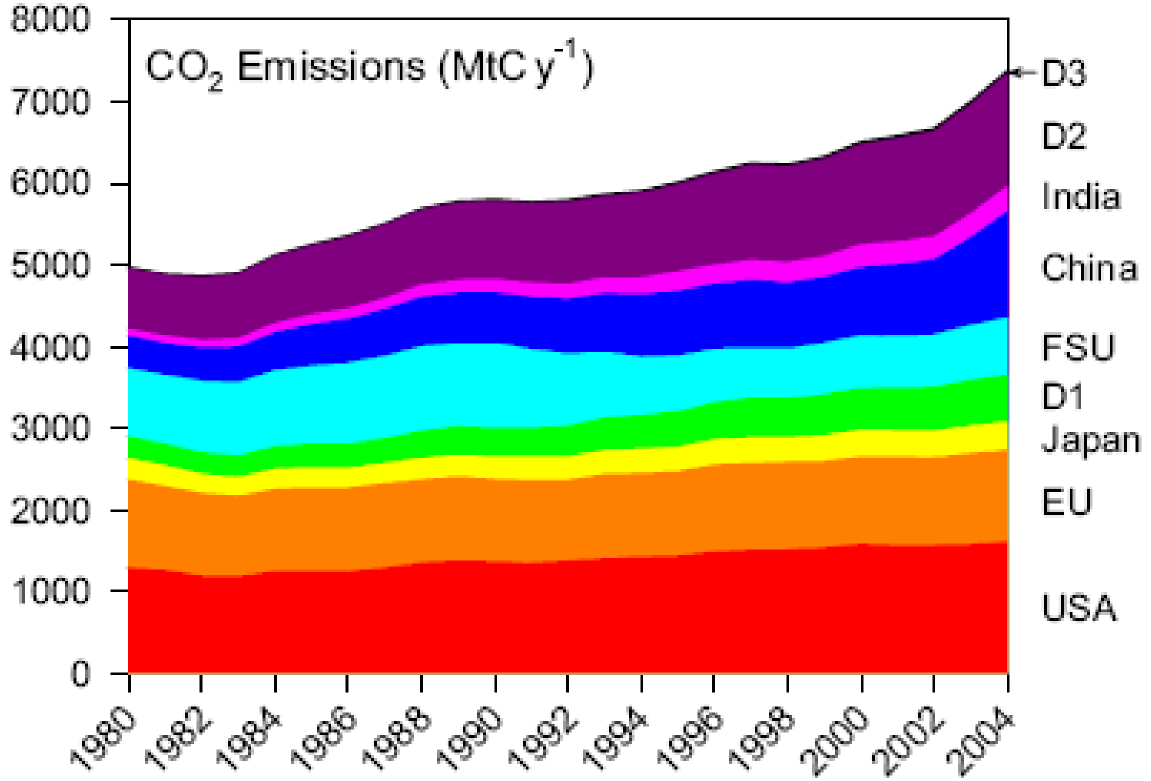


(3) Carbon budget at regional or global scale

❑ Estimate regional and global carbon budget

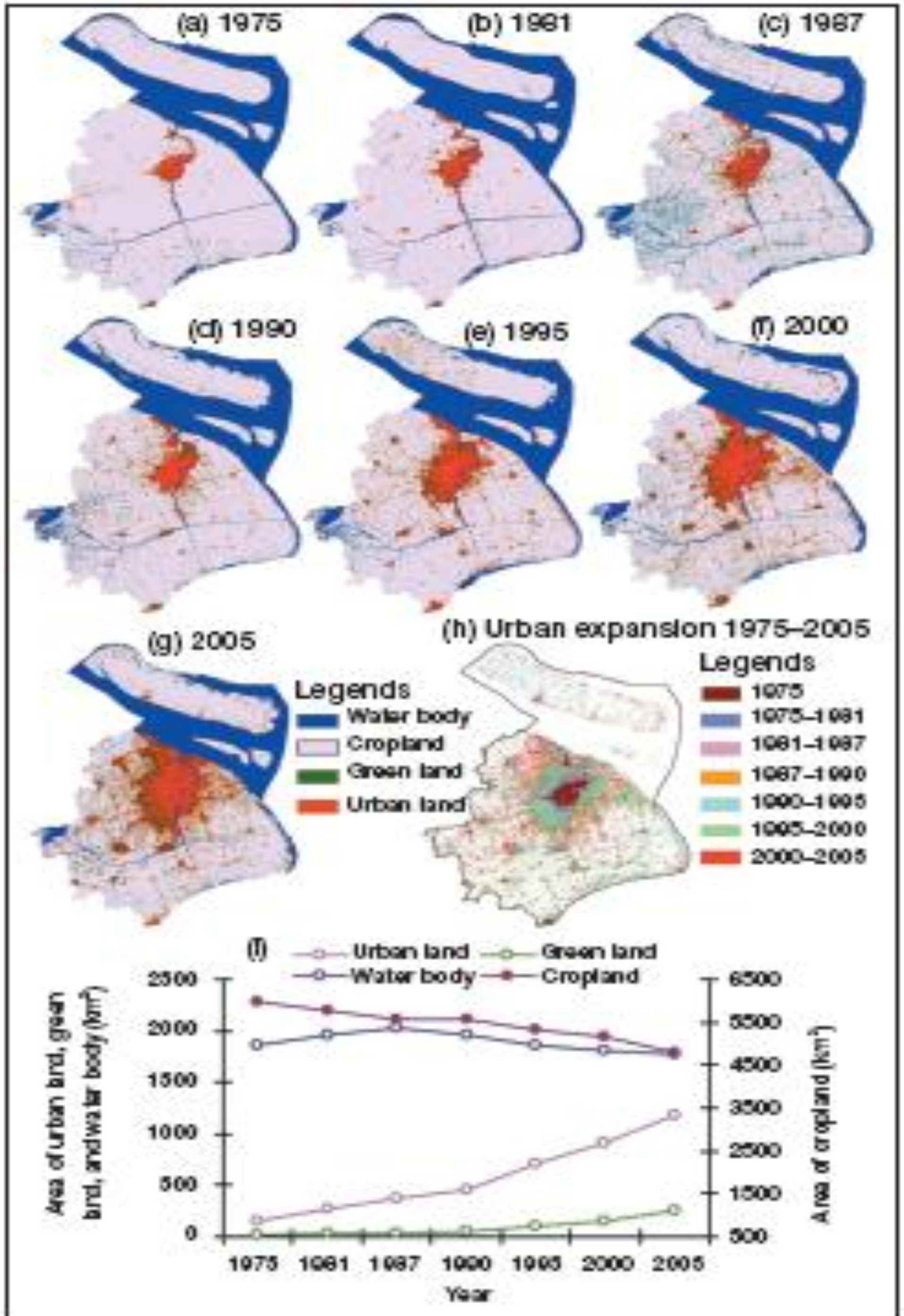


It is of critical importance to quantify China's carbon budget



In parallel with the recent economic boom in China, fossil fuel CO2 emissions have climbed from 0.4 PgC yr-1 in 1980 to 1.5 PgC yr-1 in 2006, placing China as the largest emitter in the world.

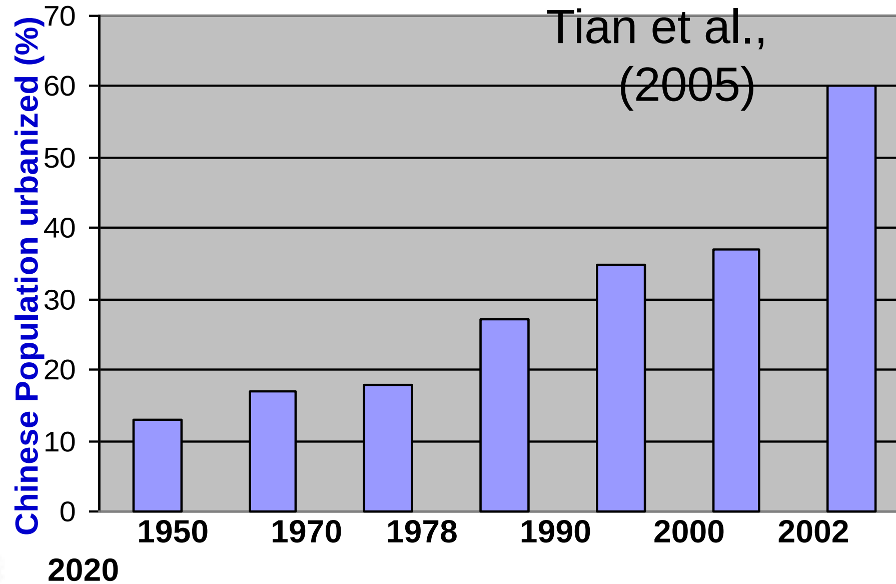
Raupach et al.,



Rapid Urbanization

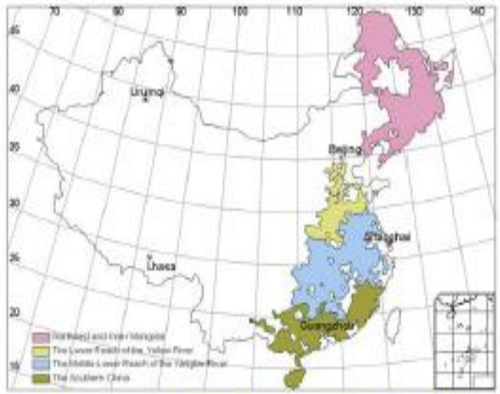
Carbon loss from new urban settlements

Carbon gain since movement of rural population to cities have diminished the collection of fuel wood, accelerating the recovery of vegetation

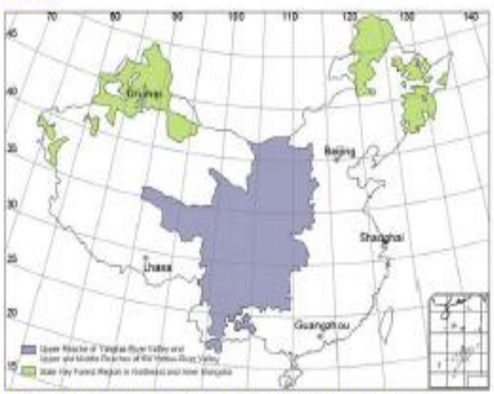


Afforestation/reforestation projects

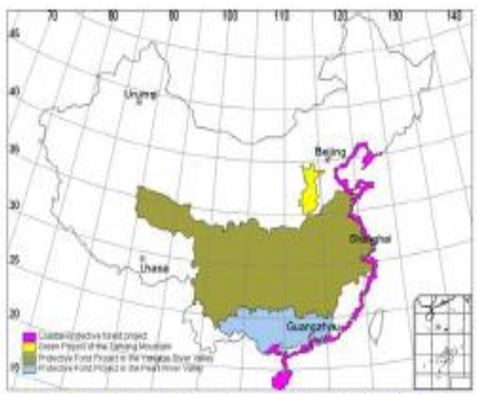
Three-North protective forest and sand-control plantation surrounding Beijing



Fast-growing high yield timber forest bases project of key regions



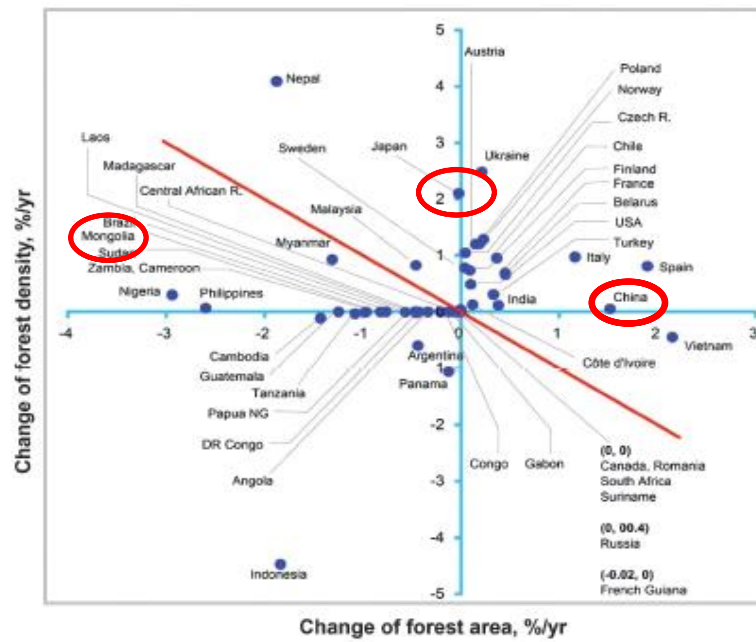
Protective Project of Natural Forests



River valley and coastal protective project

-China contributed about one quarter of the global plantation area.

-Forest plantation benefit net carbon uptake

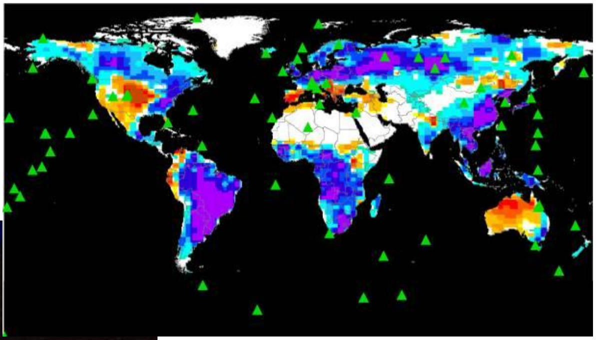


Kauppi et al., (2006)

(3) Carbon budget at regional or global scale

1000 km

Atmospheric inverse Model



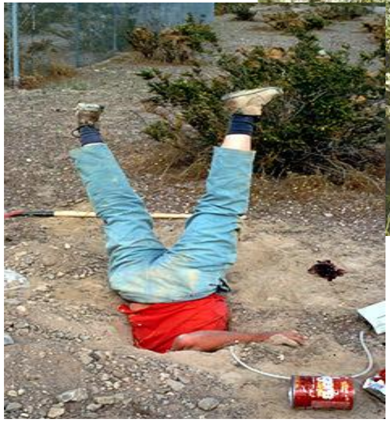
10 km

Upscaling

Prediction

ha

dm

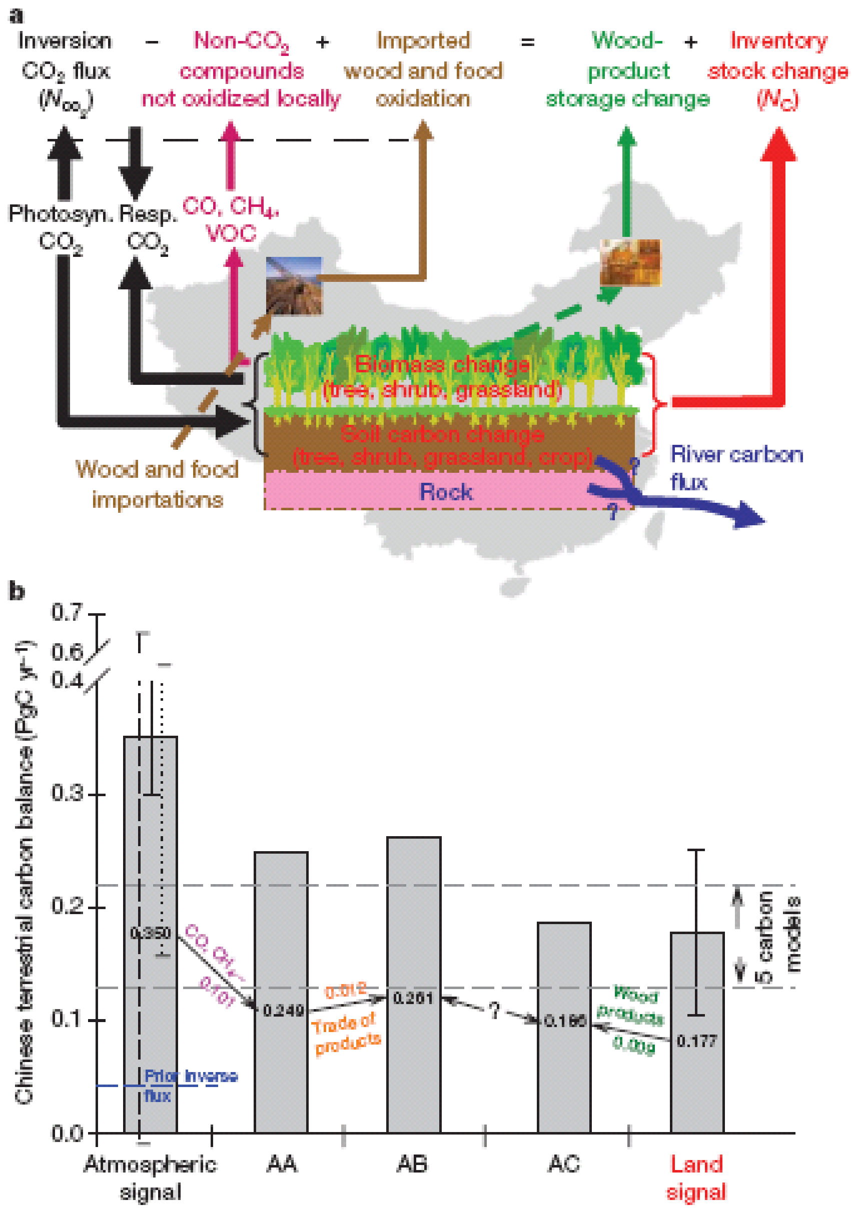


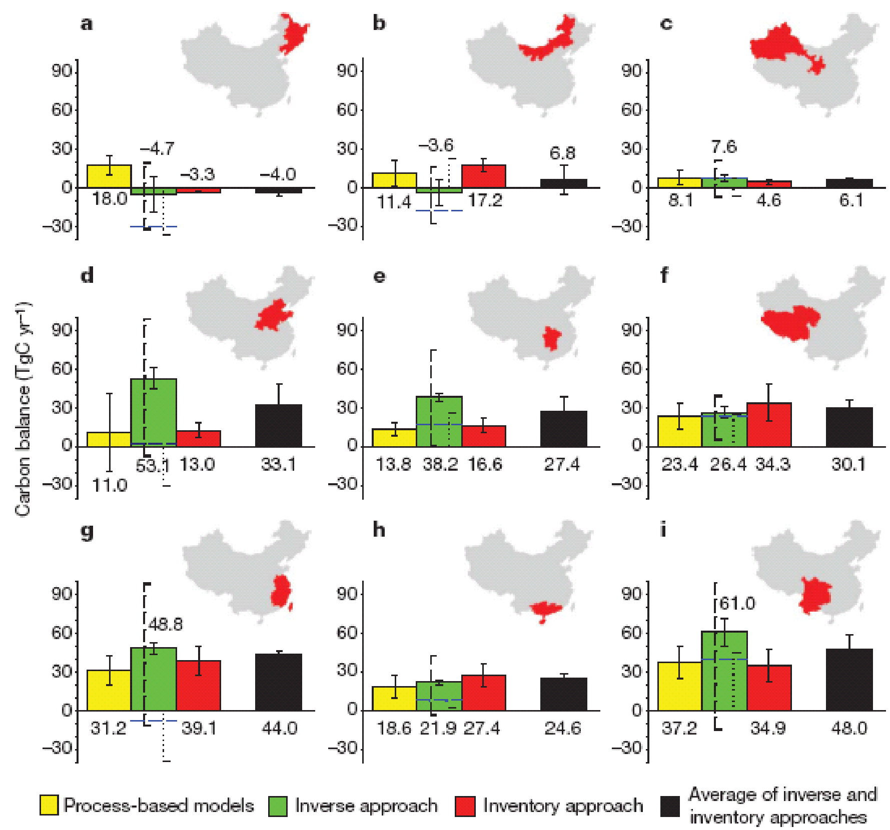
Downscaling

Verification

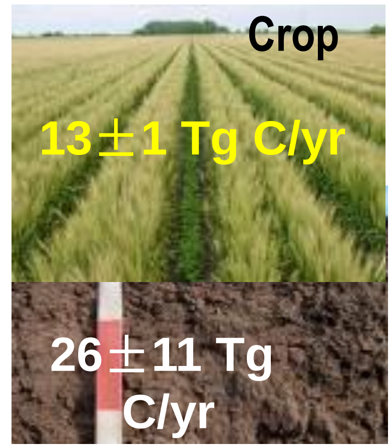
+ Integration by modeling (**Moses-Triffid; LPJ; Sheffield-DGVM; Hyland; ORCHIDEE**)

(3) Carbon budget at regional or global scale



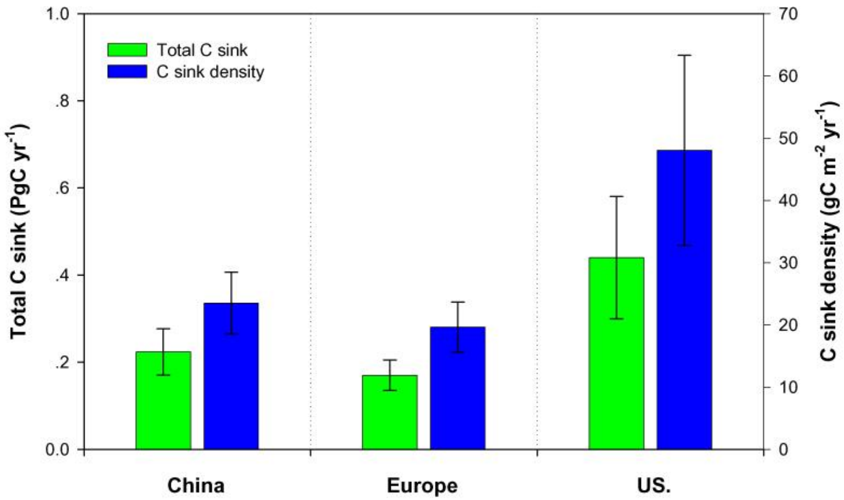


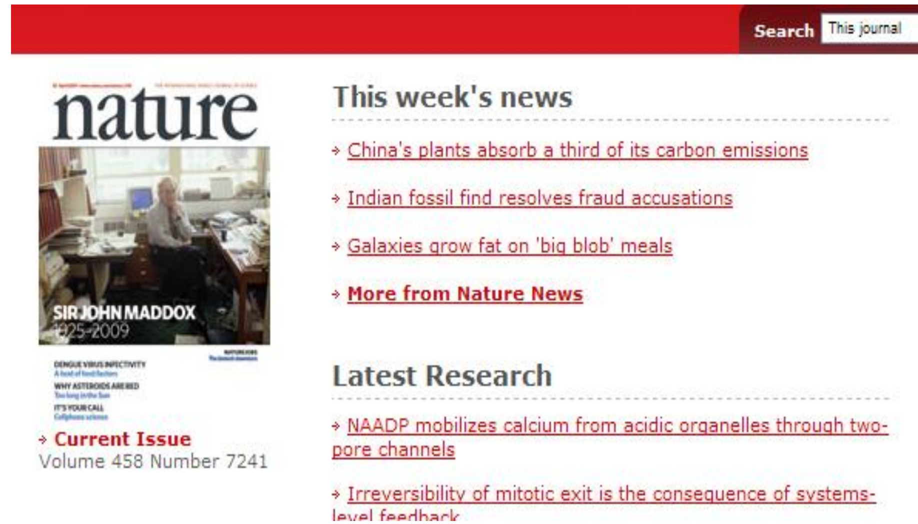
(3) Carbon budget at regional or global scale

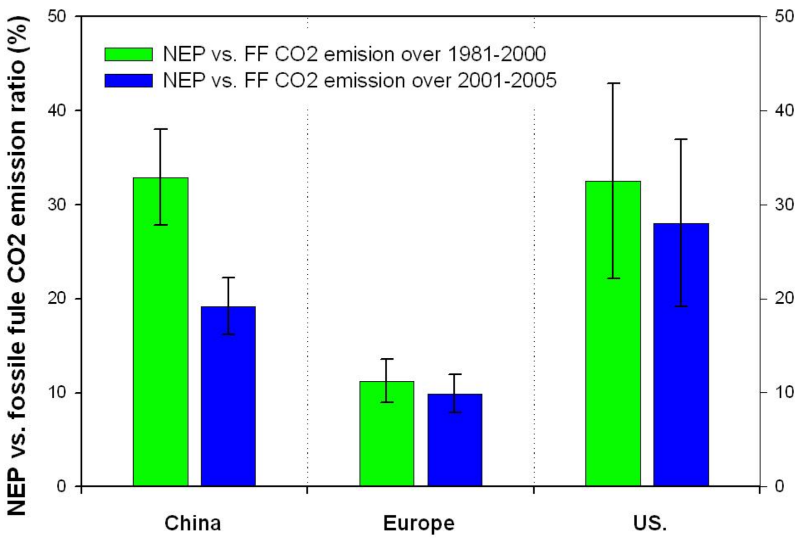


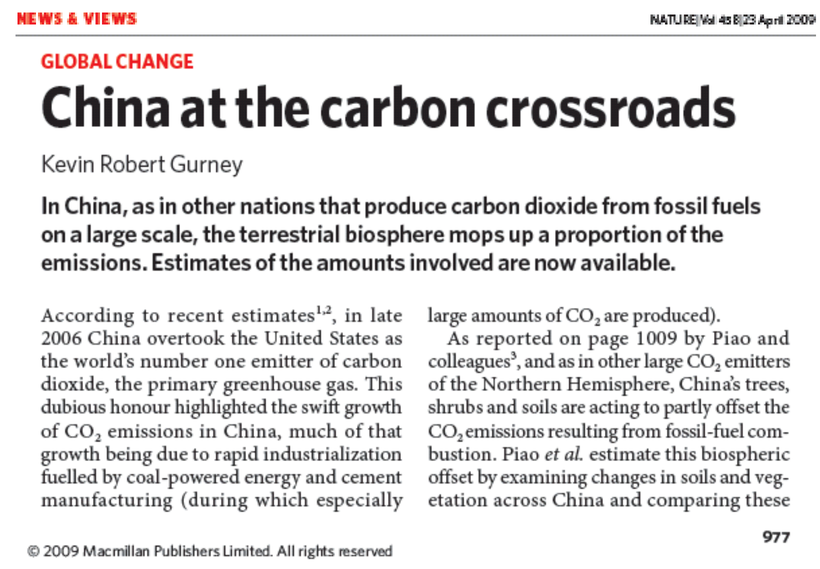
177±73 Tg C/yr =

(3) Carbon budget at regional or global scale









NEWS & VIEWS

NATURE|Vol 458|23 April 2009

GLOBAL CHANGE

China at the carbon crossroads

Kevin Robert Gurney

In China, as in other nations that produce carbon dioxide from fossil fuels on a large scale, the terrestrial biosphere mops up a proportion of the emissions. Estimates of the amounts involved are now available.

According to recent estimates[1,2], in late 2006 China overtook the United States as the world's number one emitter of carbon dioxide, the primary greenhouse gas. This dubious honour highlighted the swift growth of CO_2 emissions in China, much of that growth being due to rapid industrialization fuelled by coal-powered energy and cement manufacturing (during which especially large amounts of CO_2 are produced).

As reported on page 1009 by Piao and colleagues[3], and as in other large CO_2 emitters of the Northern Hemisphere, China's trees, shrubs and soils are acting to partly offset the CO_2 emissions resulting from fossil-fuel combustion. Piao *et al.* estimate this biospheric offset by examining changes in soils and vegetation across China and comparing these

977

(4) The impact of climate change on water resource

- **Estimate the impact of change in climate and land use on water resource**

IOP Publishing — Environmental Research Letters
Environ. Res. Lett. 4 (2009) 044012 (6pp) — doi:10.1088/1748-9326/4/4/044012

Summer soil moisture regulated by precipitation frequency in China

Shilong Piao[1,5], Lei Yin[2], Xuhui Wang[1], Philippe Ciais[3], Shushi Peng[1], Zehao Shen[1] and Sonia I Seneviratne[4]

[1] Department of Ecology, College of Environmental Science and Key Laboratory for Earth Surface Processes of the Ministry of Education, Peking University, Beijing 100871, People's Republic of China
[2] School of Atmospheric Sciences, Nanjing University, Nanjing 210000, People's Republic of China
[3] LSCE, UMR CEA-CNRS, Batiment 709, CE, L'Orme des Merisiers, F-91191 Gif-sur-Yvette, France
[4] Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

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PNAS

Changes in climate and land use have a larger direct impact than rising CO_2 on global river runoff trends

Shilong Piao*, Pierre Friedlingstein*†, Philippe Ciais*, Nathalie de Noblet-Ducoudré*, David Labat‡, and Sönke Zaehle*

atmospheric CO_2 | water cycle | climate change | land cover change

Vol 467 | 2 September 2010 | doi:10.1038/nature09364 — nature

REVIEWS

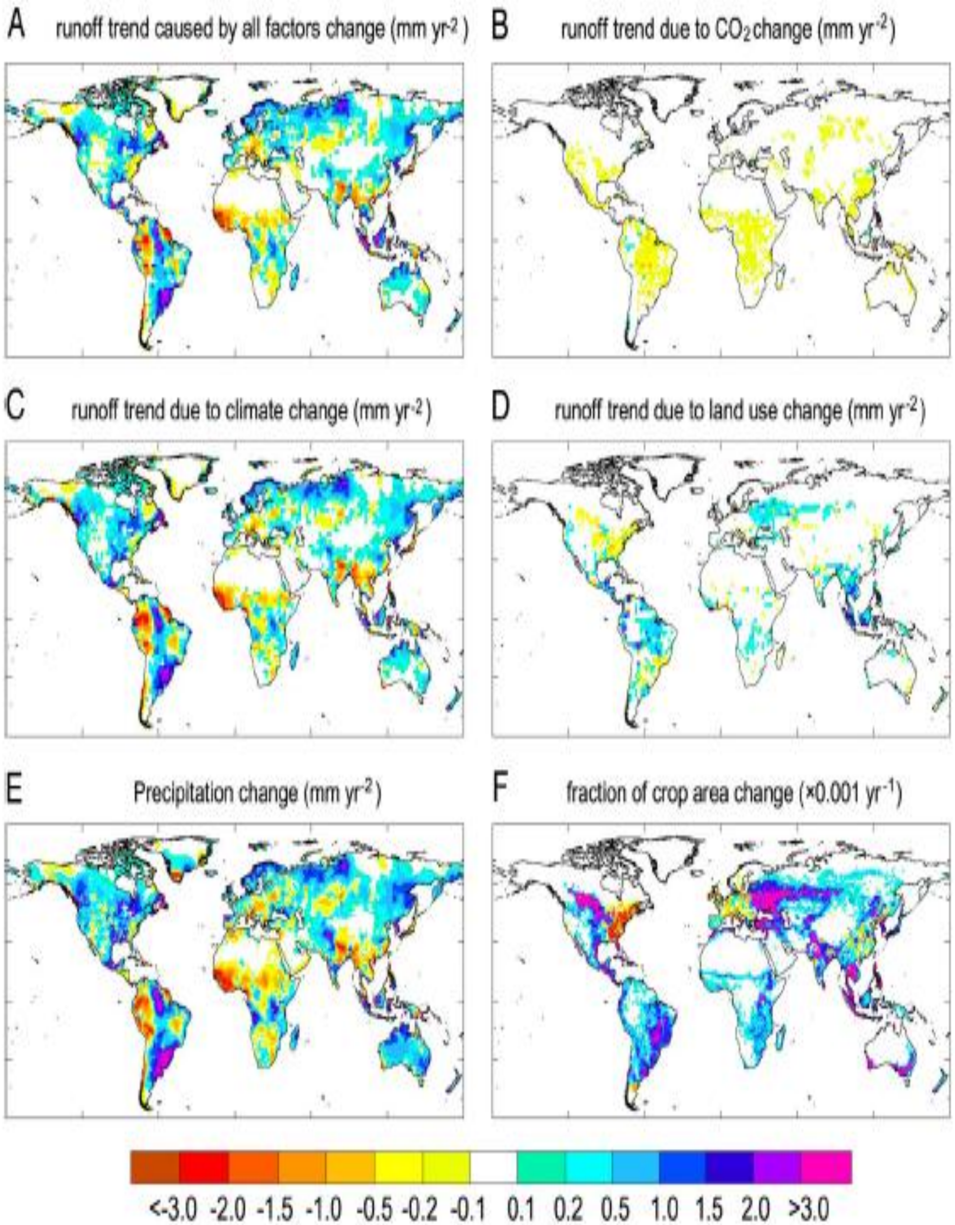
The impacts of climate change on water resources and agriculture in China

Shilong Piao[1], Philippe Ciais[2], Yao Huang[3], Zehao Shen[1], Shushi Peng[1], Junsheng Li[4], Liping Zhou[1], Hongyan Liu[1], Yuecun Ma[1], Yihui Ding[5], Pierre Friedlingstein[2,6], Chunzhen Liu[7], Kun Tan[1], Yongqiang Yu[3], Tianyi Zhang[3] & Jingyun Fang[1]

China is the world's most populous country and a major emitter of greenhouse gases. Consequently, much research has focused on China's influence on climate change but somewhat less has been written about the impact of climate change on China. China experienced explosive economic growth in recent decades, but with only 7% of the world's arable land available to feed 22% of the world's population, China's economy may be vulnerable to climate change itself. We find, however, that notwithstanding the clear warming that has occurred in China in recent decades, current understanding does not allow a clear assessment of the impact of anthropogenic climate change on China's water resources and agriculture and therefore China's ability to feed its people. To reach a more definitive conclusion, future work must improve regional climate simulations—especially of precipitation—and develop a better understanding of the managed and unmanaged responses of crops to changes in climate, diseases, pests and atmospheric constituents.

Changes in climate and land use have a larger direct impact than rising CO_2 on global river runoff trends

(4) The impact of climate change on water resource



-------- Message original --------
Sujet: PNAS
Date: Mon, 4 Feb 2008 13:33:39 -0500
De: Weiss, Nathan <NWeiss@nas.edu>
Pour: <pierre.friedlingstein@lsce.ipsl.fr>

February 4, 2008

Dear Dr. Friedlingstein:

The Editorial Board of the /Proceedings of the National Academy of Sciences /(PNAS) would like to thank you for publishing in PNAS. We are pleased to report that your PNAS paper, "Changes in climate and land use have a larger direct impact than rising CO2 on global river runoff trends" is one of our 20 most-read papers online during the month of December 2007 (www.pnas.org/reports/mfr1.dtl <http://www.pnas.org/reports/mfr1.dtl>)/. /We expect this online interest will result in increased citations of your paper./ /

/ /

Thank you for choosing to publish such interesting and important work in

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Changes in climate and land use have a larger direct impact than rising CO2 on global river runoff trends.
Piao S, Friedlingstein P, ..., Labat D, Zaehle S
Proc Natl Acad Sci U S A 2007 Sep 25 **104** (39):15242-7 [abstract on PubMed] [related articles] [FREE full text] [order article

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"Land use and climate change are bigger contributors to observed increases in river..."

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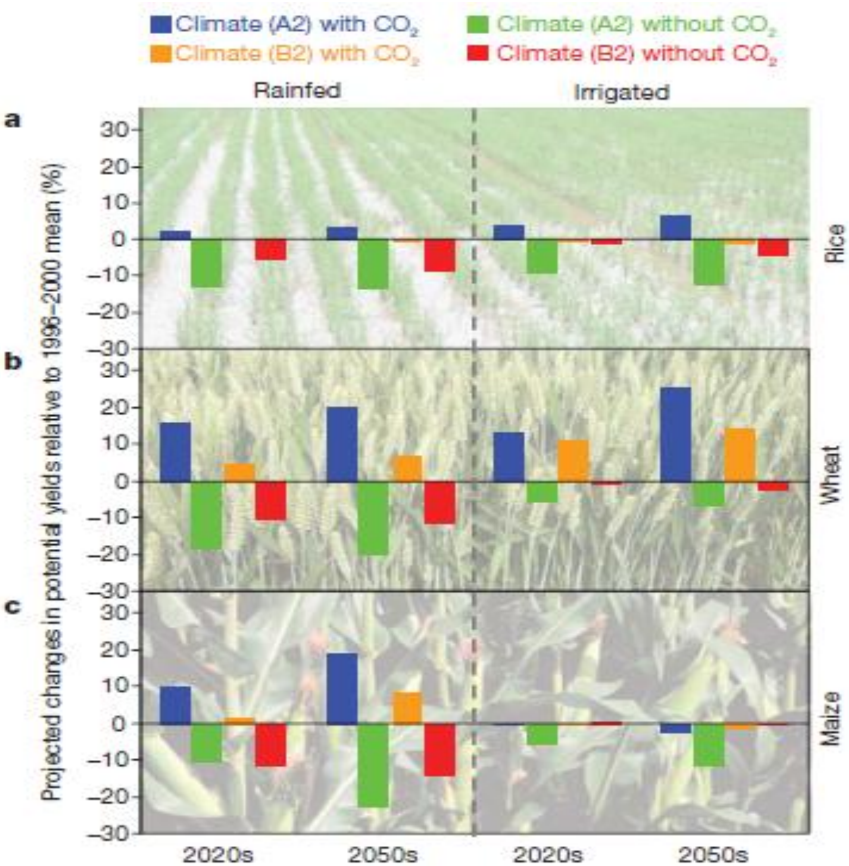
(4) The impact of climate change on water resource

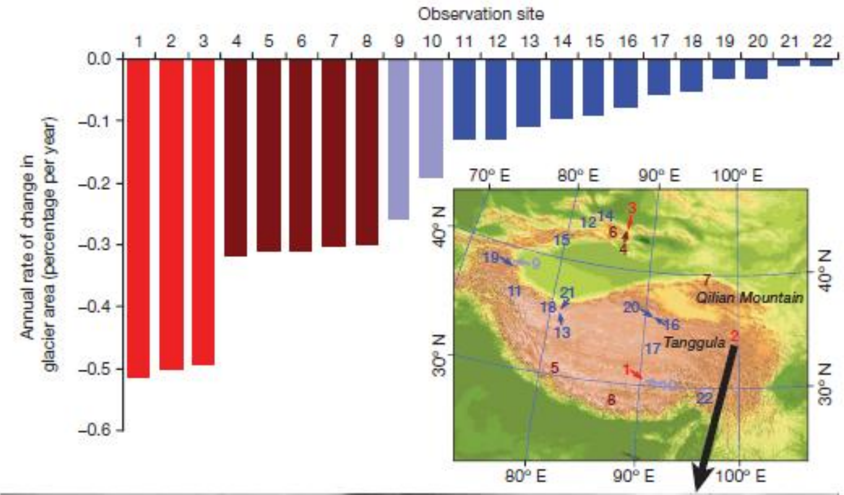
Vol 467|2 September 2010|doi:10.1038/nature09364 nature

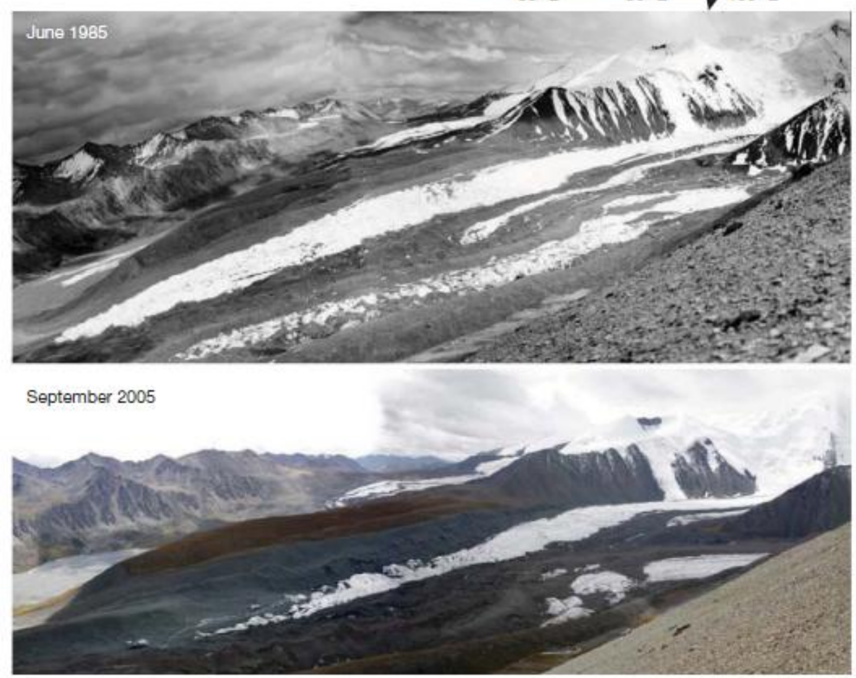
REVIEWS

The impacts of climate change on water resources and agriculture in China

Shilong Piao[1], Philippe Ciais[2], Yao Huang[3], Zehao Shen[1], Shushi Peng[1], Junsheng Li[4], Liping Zhou[1], Hongyan Liu[1], Yuecun Ma[1], Yihui Ding[5], Pierre Friedlingstein[2,6], Chunzhen Liu[7], Kun Tan[1], Yongqiang Yu[3], Tianyi Zhang[3] & Jingyun Fang[1]







Publication (2007-)

Journal	Number	发表年份
Nature	3	2008-2010
PNAS	2	2007,2011
Nature Geosciences	2	2008, 2010
Ecology	1	2010
Global Change Biology	7	2007-
Global Biogeochem Cycles	4	2007-2010
Biogeosciences	3	2009,2010
J. Geophysical Research	1	2011
Geophysical Res. Letters	2	2007, 2009
Soil Biology and Biochemistry	2	2009, 2010
Global and Planetary Change	1	2011
Environmental Research Letters	1	2009
Others	8	2007-
Total	37	2007-

The Carbones Project

30-year re-analysis of CARBON fluxES and pools

over Europe and the Globe


Carbones web site:
(April 2011)
Contact coordination NOVELTIS – Pascal Prunet
THANK YOU FOR YOUR KIND ATTENTION

Visits of students, post-docs and senior staff

Name	Status	Time	Duration
Shilong Piao	Post Dr	2004-2007	3 years
Kun Tan	Post Dr	2010.3-	3 years
Tao Wang	PhD	2008.10-	3 years
Chao Yue	PhD	2010.11-	3 years
Jingfeng Chang	PhD	2011.2-	3 years
Jingyun Fang	Visit as Prof.	2008.4	2 days
Shushi Peng	Visit as PhD student	2008.11-12	1 month
Xuhui Wang	Visit as Ms student	2010.9-11	2 months
Kun Tan	Visit as PhD student	2008.3-10	7 months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Thanks !