全球变化与地球生态系统服务功能

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主要内容

一、生态系统多样性与服务功能

二、生物圈2号实验的启示

三、全球变化与地球生态系统服务功能

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Benjamin
Cummings

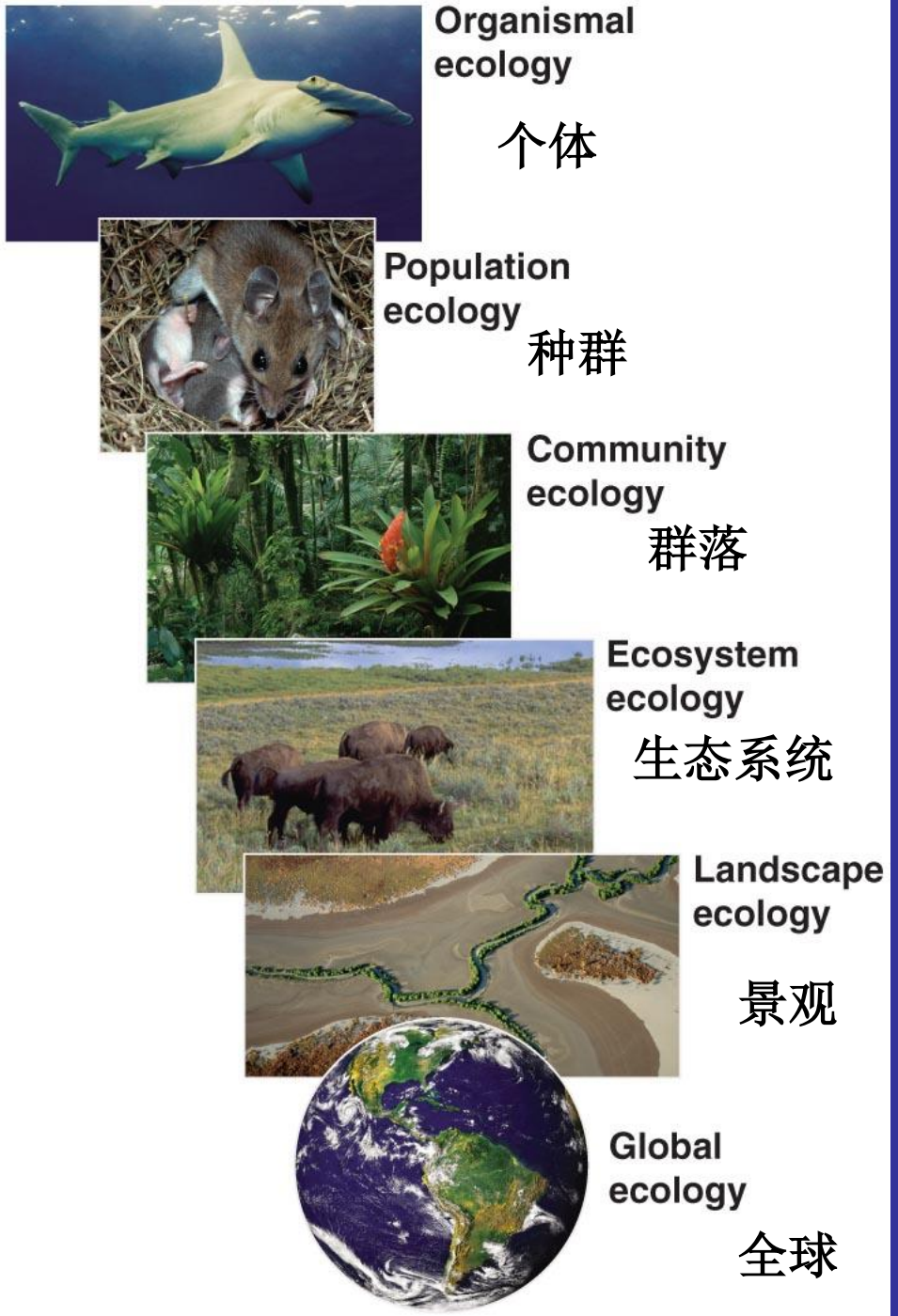
Diversity of Life on Earth

- Animal kingdom ~ 1,100,000 species
- Plant kingdom ~ 800,000 sp.
- Fungal kingdom ~ 100,000 sp.
- Protist kingdom ~ 100,000 sp.
- Prokaryotic domains ~ who knows ??

Total > 2,000,000 +

estimates up to ~ 30,000,000

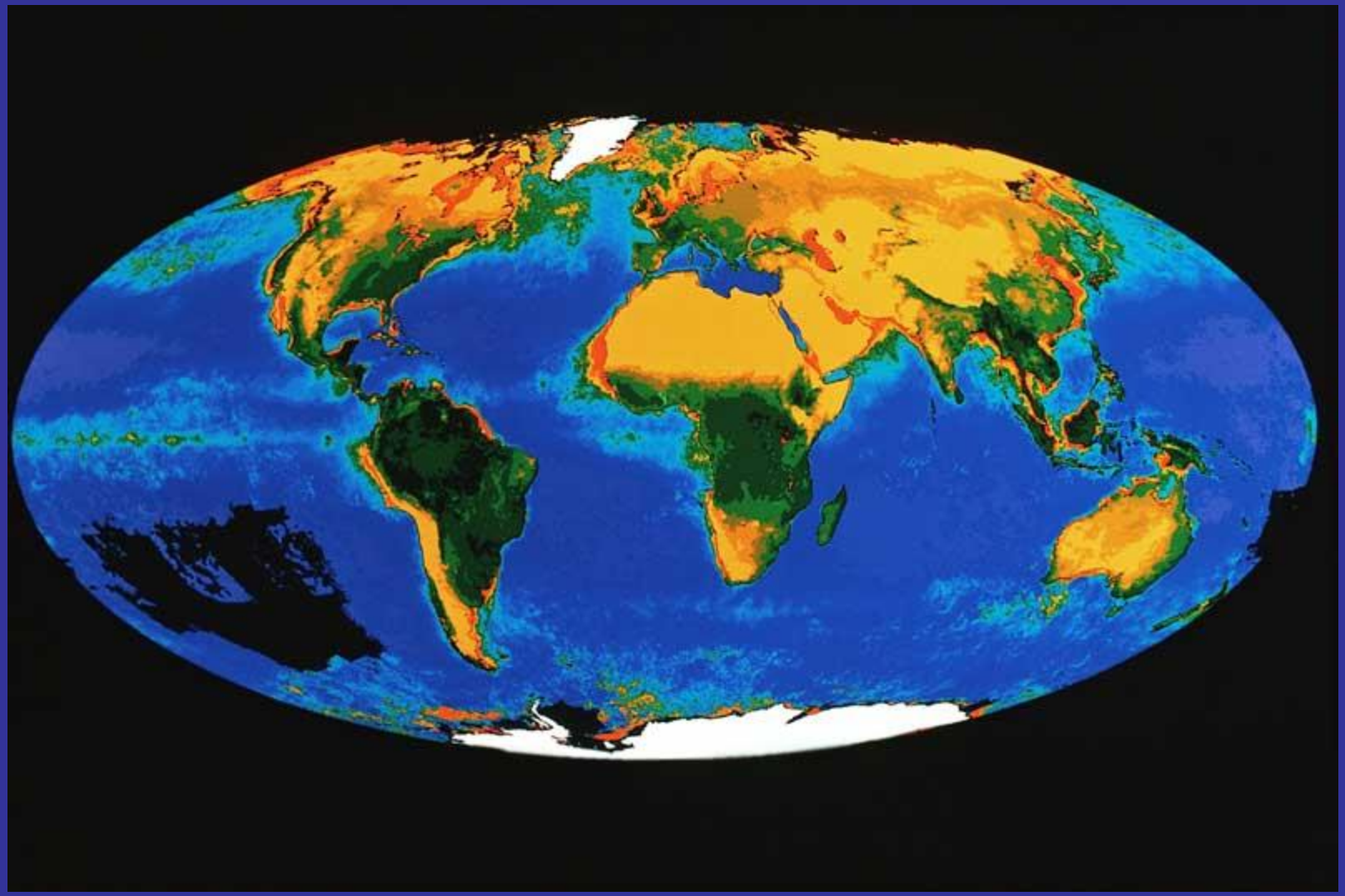
Levels of Life Organization

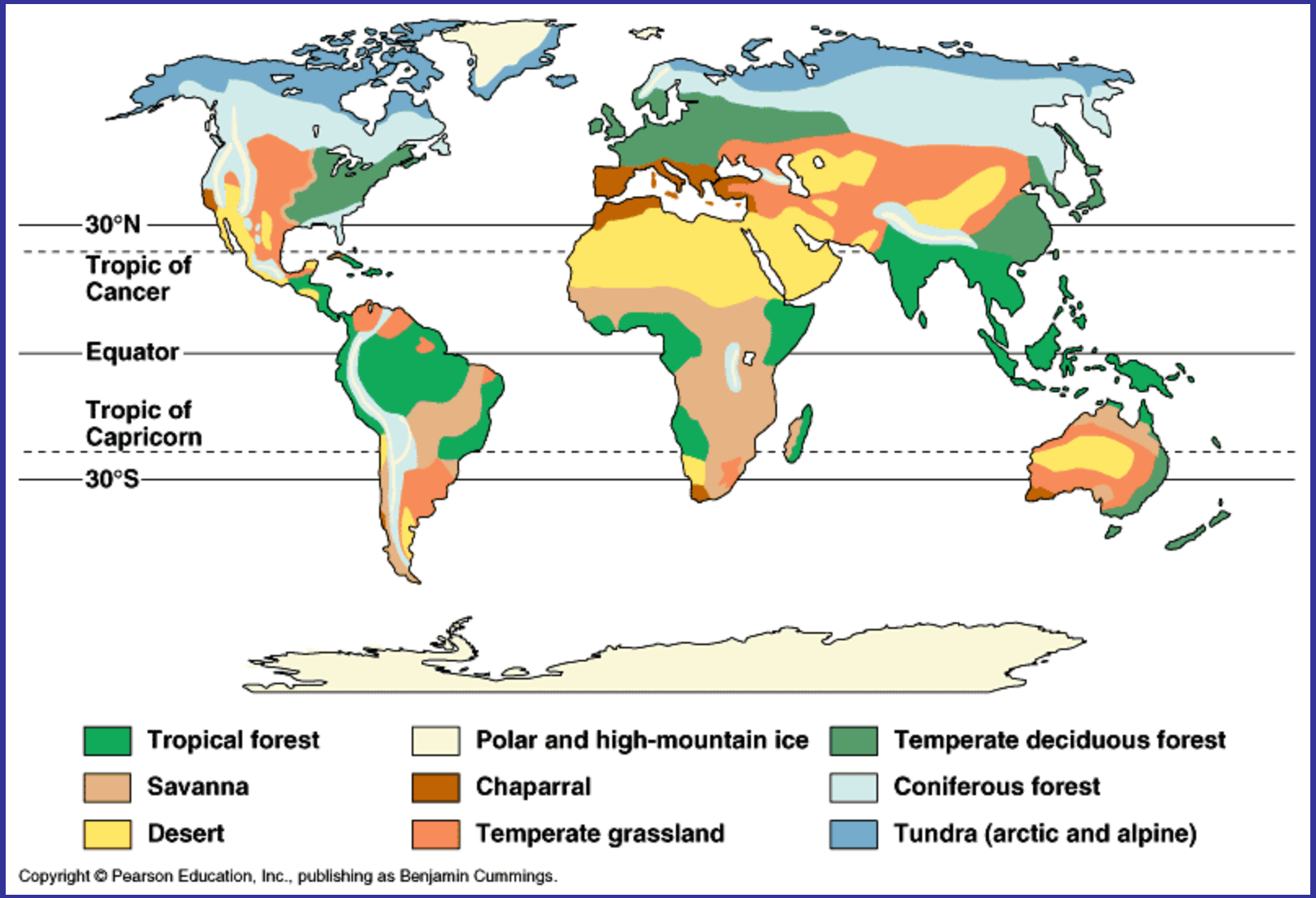


Aquatic and terrestrial biomes

（生物群系、大生态区）

(Biome = major ecosystem type)





Tropical Forest: Vertical stratification with trees in canopy blocking light to bottom strata. Many trees covered by epiphytes (plants that grow on other plants).

热带雨林

热带雨林的主要特征

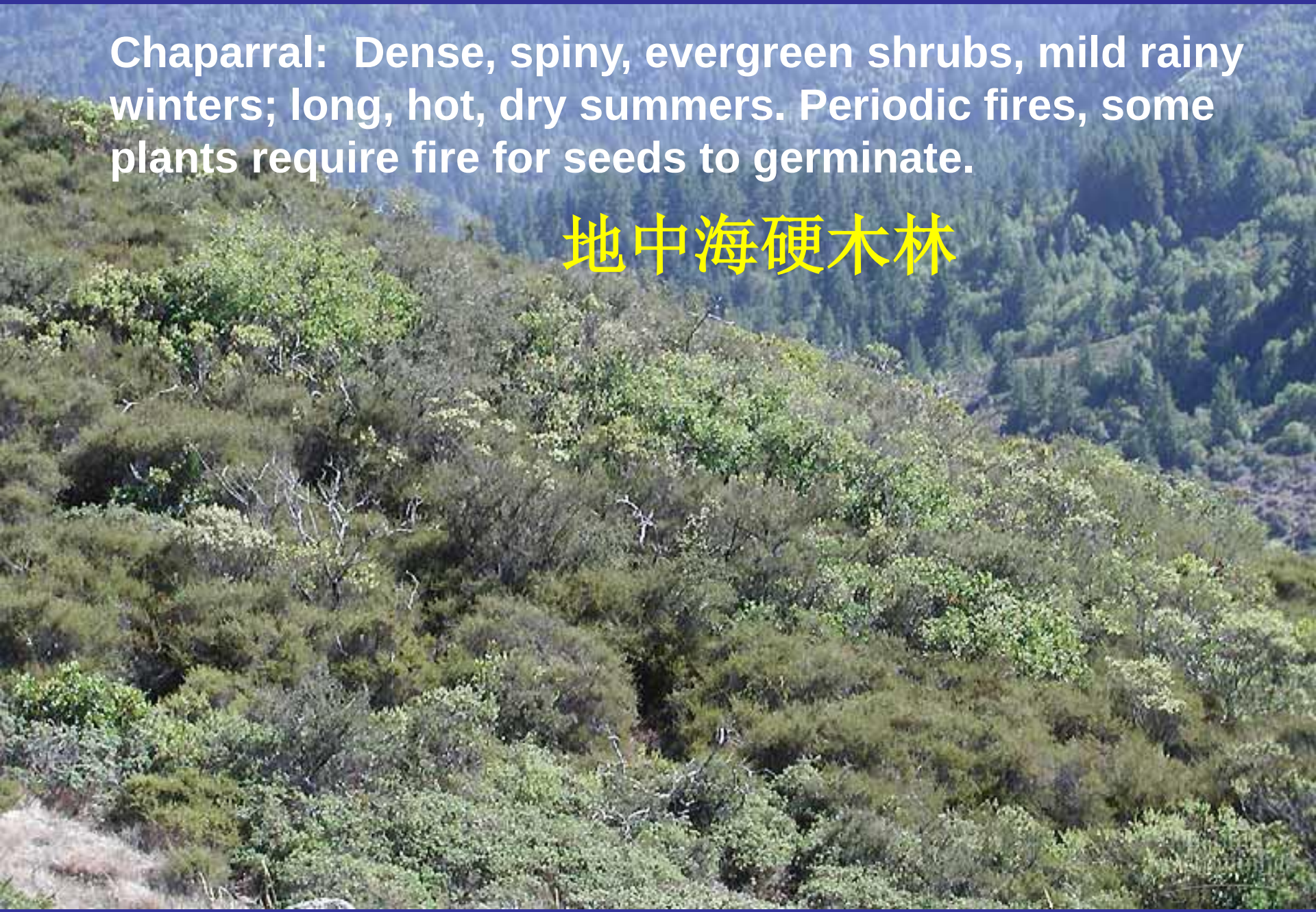

2007 11 29
云南西双版纳

Tropical Savanna

热带稀树干草原

非洲：津巴布韦

Desert: Sparse rainfall (< 30 cm per year), plants and animals adapted for water storage and conservation. Can be either very, very hot, or very cold (e.g. Antarctica)



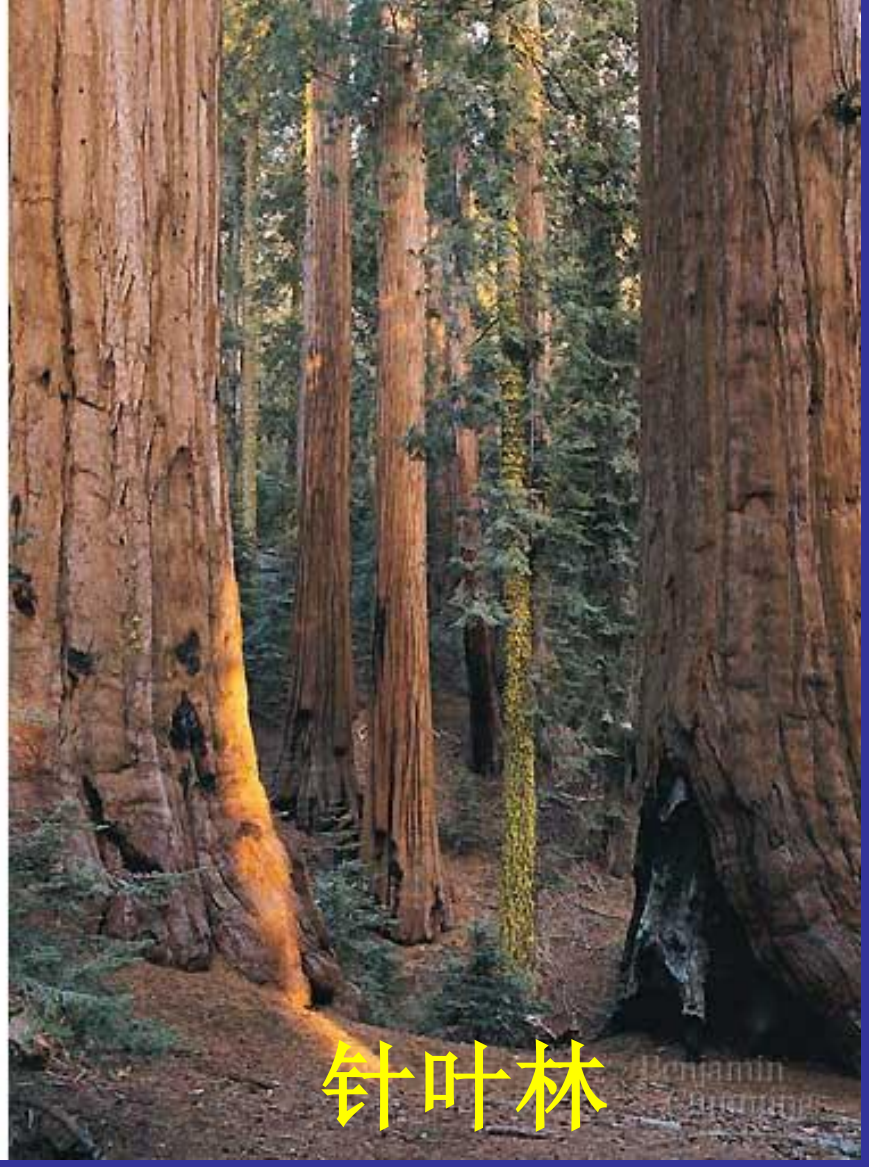
Chaparral: Dense, spiny, evergreen shrubs, mild rainy winters; long, hot, dry summers. Periodic fires, some plants require fire for seeds to germinate.

地中海硬木林

Temperate Grassland: Marked by seasonal drought and fires, and grazing by large animals.

温带草原

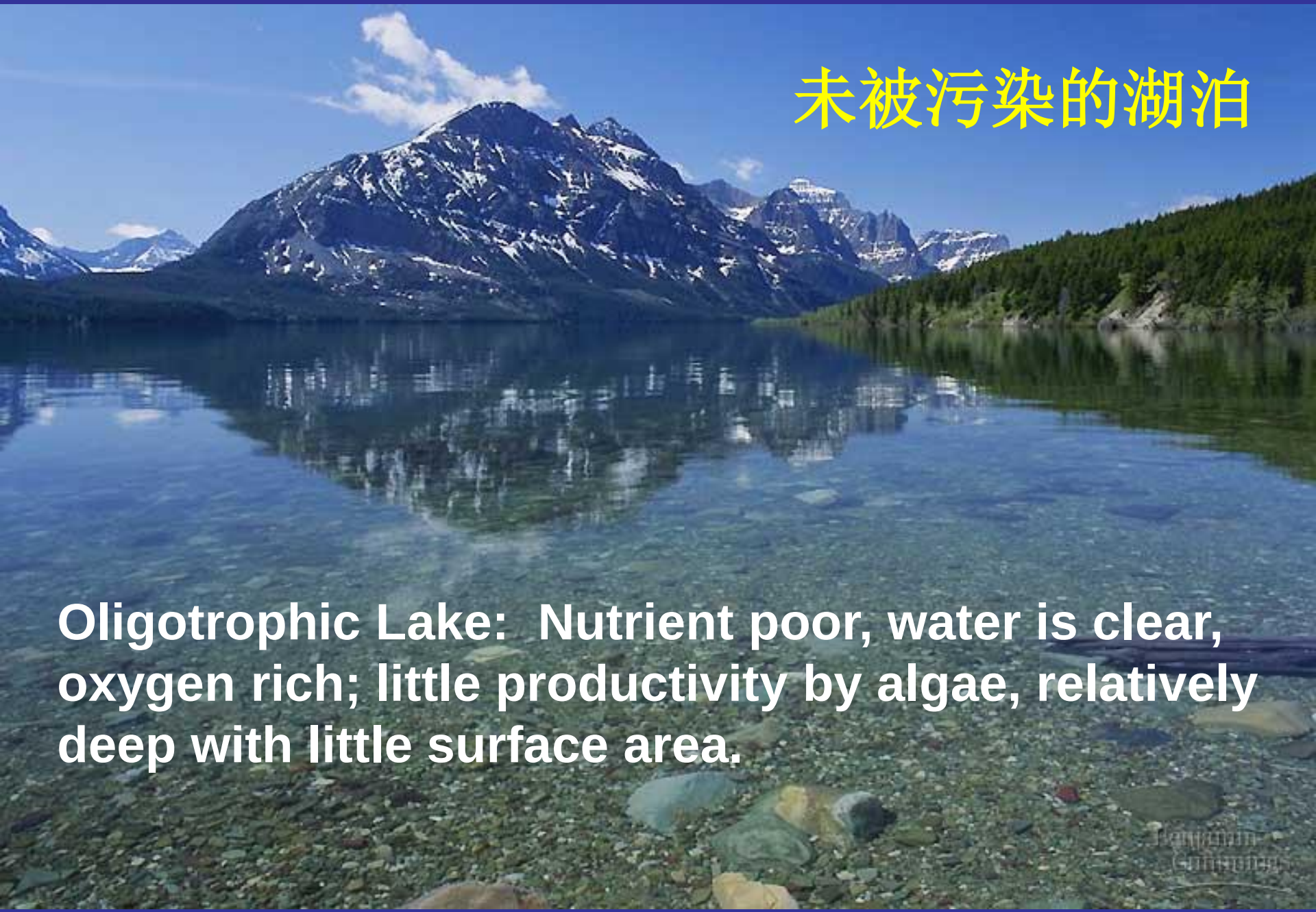

Temperate Deciduous Forest: Mid-latitudes with moderate amounts of moisture, distinct vertical strata: trees, understory shrubs, herbaceous sub-stratum. Loss of leaves in cold, many animals hibernate or migrate then. Original forests lost from North America by logging and clearing.
温带落叶林



Coniferous forest: Largest terrestial biome on earth, old growth forests rapidly disappearing, usually receives lots of moisture as rain or snow.

美国巨杉 （>200 米高）

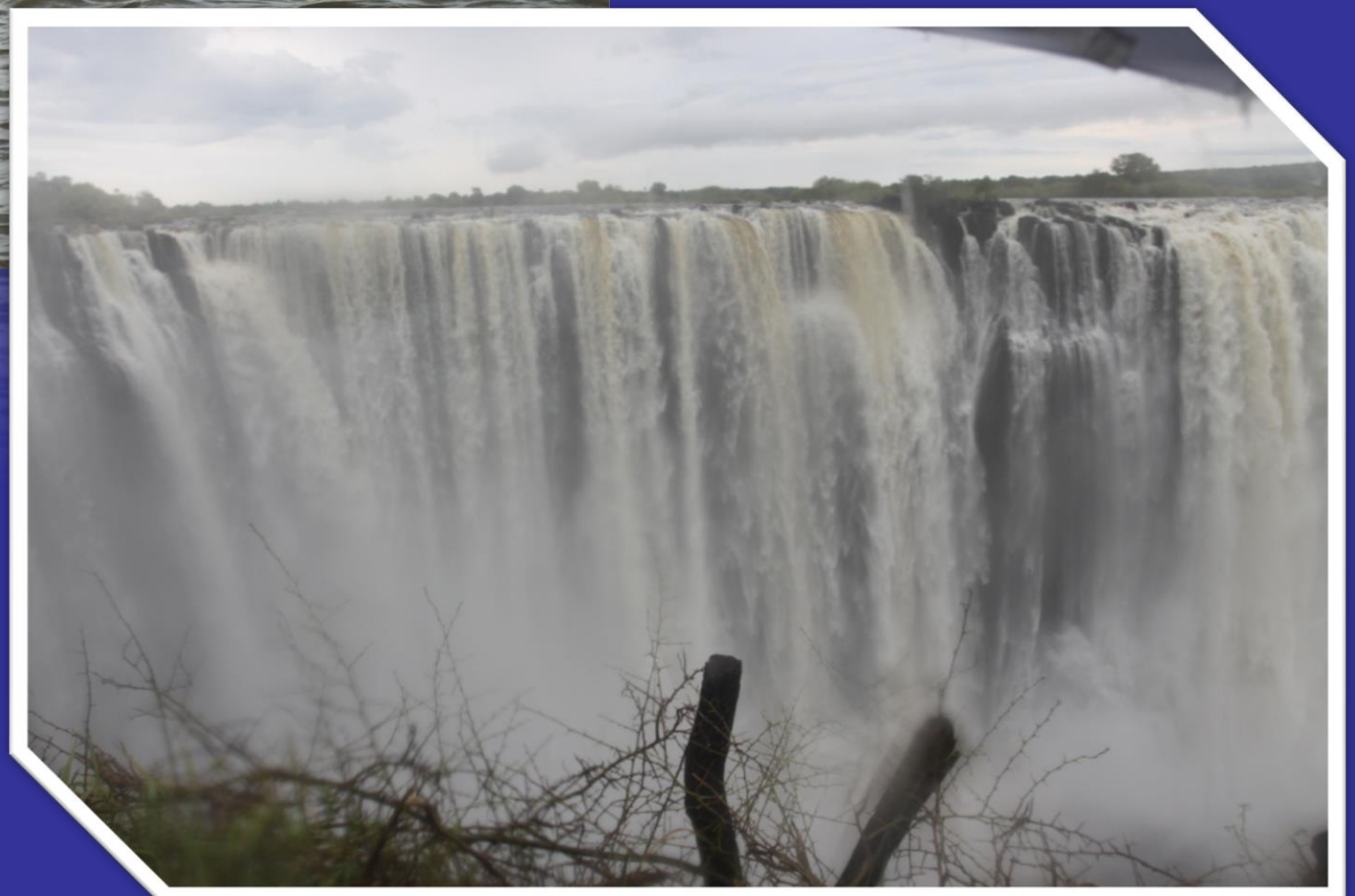
Tundra: Permafrost (Permanent frozen ground), bitter cold, high winds and thus no trees. Has 20% of land surface on earth.



Oligotrophic Lake: Nutrient poor, water is clear, oxygen rich; little productivity by algae, relatively deep with little surface area.

西藏那木错湖

津巴布韦



Rivers and Streams: Organisms need adaptations so that they are not swept away by moving water; heavily affected by man changing the course of flow (E.g. dams and channel-straightening) and by using rivers to dispose of waste.

桂林风光甲天下

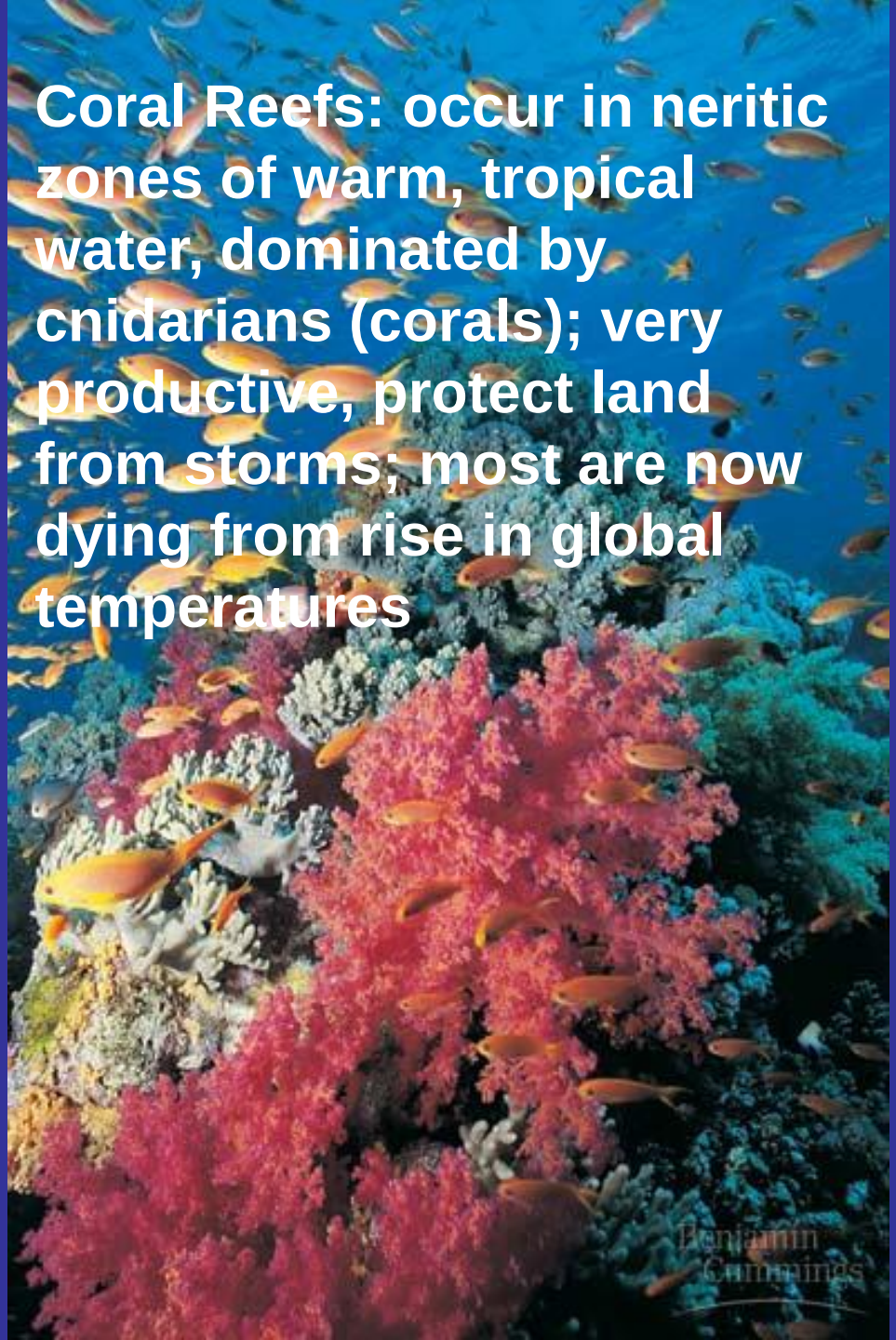
Estuary: Place where freshwater stream or river merges with the ocean. Highly productive biome; important for fisheries and feeding places for water fowl. Often heavily polluted from river input so many fisheries are now lost.

Coastal wetlands: Mangroves

福建云霄漳江口

盐沼
Salt marshes

Coral reef
珊瑚礁



What do these ecosystems mean to us?

生态系统服务的定义

- 生态系统服务（ecosystem services）由Holdren和Ehrlich（1974）提出，指对人类生存和生活质量有贡献的生态系统产品（goods）和服务（services）；

- 产品指在市场上用货币表现的商品，服务指不能在市场上买卖，但具有重要价值的生态系统的性能，如净化环境、保持水土、减轻灾害等。

生态系统服务项目内容

表 12-7　生态系统服务项目一览表

生态系统服务	内容	举例
1. 气体调节	大气化学成分调节	CO_2/O_2 平衡，O_3 防紫外线、SO_2 水平
2. 气候调节	全球温度、降水及其他由生物媒介的全球及地区性气候调节	温室气体调节，影响云形成的 DMS 产物
3. 干扰调节	生态系统对环境波动的容量、衰减和综合反应	风暴防止、洪水控制、干旱恢复等生境对主要受植被结构控制的环境变化的反应
4. 水调节	水文流动调节	为农业、工业和运输提供用水
5. 水供应	水的贮存和保持	向集水区、水库和含水岩层供水
6. 控制侵蚀和保持沉积物	生态系统内的土壤保持	防止土壤被风、水侵蚀，把淤泥保存在湖泊和湿地中
7. 土壤形成	土壤形成过程	岩石风化和有机质积累

生态系统服务项目内容(续)

生态系统服务	内容	举例
8. 养分循环	养分的贮存、内循环和获取	固氮，N、P 和其他元素及养分循环
9. 废物处理	易流失养分的再获取，过多或外来养分、化合物的去除或降解	废物处理，污染控制，解除毒性
10. 传粉	有花植物配子的运动	提供传粉者以便植物种群繁殖
11. 生物防治	生物种群的营养动力学控制	关键捕食者控制被食者种群，顶位捕食者使食草动物减少
12. 避难所	为常居和迁徙种群提供生境	育雏地、迁徙动物栖息地、当地收获物种栖息地或越冬场所
13. 食物生产	总初级生产中可用为食物的部分	通过渔、猎、采集和农耕收获的鱼、鸟兽、作物、坚果、水果等
14. 原材料	总初级生产中可用为原材料的部分	木材、燃料和饲料产品
15. 基因资源	独一无二的生物材料和产品的来源	医药、材料科学产品，用于农作物抗病和抗虫基因，家养物种（宠物和植物栽培品种）
16. 体闲娱乐	提供休闲旅游活动机会	生态旅游、钓鱼运动及其他户外游乐活动
17. 文化	提供非商业性用途的机会	生态系统的美学、艺术、教育、精神及科学价值

NATURE 1997

The value of the world's ecosystem services and natural capital

Robert Costanza*†, Ralph d'Arge‡, Rudolf de Groot§, Stephen Farber‖, Monica Grasso†, Bruce Hannon¶, Karin Limburg#*, Shahid Naeem, Robert V. O'Neill††, Jose Paruelo‡‡, Robert G. Raskin§§, Paul Sutton‖‖ & Marjan van den Belt¶¶**

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# *Institute of Ecosystem Studies, Millbrook, New York, USA*
** *Department of Ecology, Evolution and Behavior, University of Minnesota, St Paul, Minnesota 55108, USA*
†† *Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA*
‡‡ *Department of Ecology, Faculty of Agronomy, University of Buenos Aires, Av. San Martin 4453, 1417 Buenos Aires, Argentina*
§§ *Jet Propulsion Laboratory, Pasadena, California 91109, USA*
‖‖ *National Center for Geographic Information and Analysis, Department of Geography, University of California at Santa Barbara, Santa Barbara, California 93106, USA*
¶¶ *Ecological Economics Research and Applications Inc., PO Box 1589, Solomons, Maryland 20688, USA*

The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$16–54 trillion ($10^{12}$) per year, with an average of US$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US$18 trillion per year.

全球生态系统服务的价值（Costanza *et al.*, 1997）

生态系统	面积（百万hm^2）	价值（$/$hm^2$.a）	全球价值（$万亿/a）
海洋	33,200	252	**8.4** (2)
近海水域	3102	4052	**12.6** (1)
热带森林	1900	2007	3.8
其它森林	2955	302	0.9
草地	3898	232	0.9
湿地	330	14,785	**4.9** (3)
湖泊河流	200	8498	1.7
农田	1400	92	0.1
全球总价值	=		**33.3万亿美圆**

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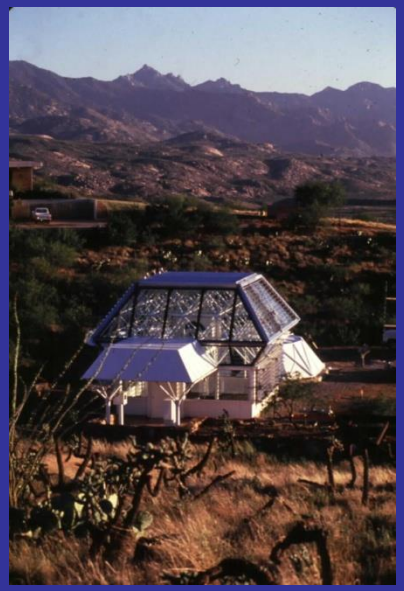
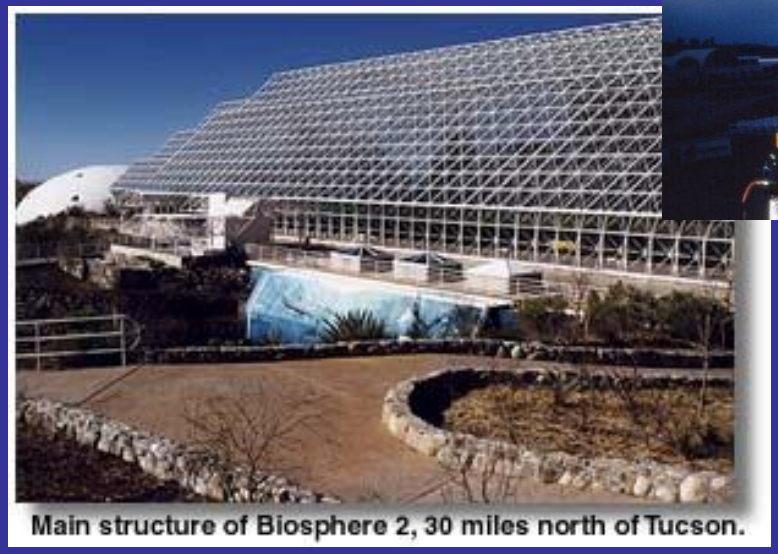
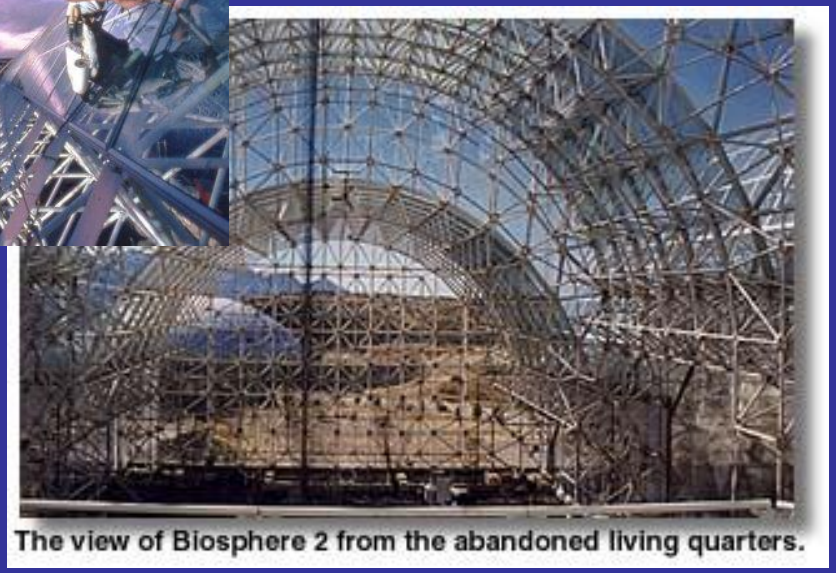
Biosphere 2
(Tucson, Arizona, USA)

Construction phase



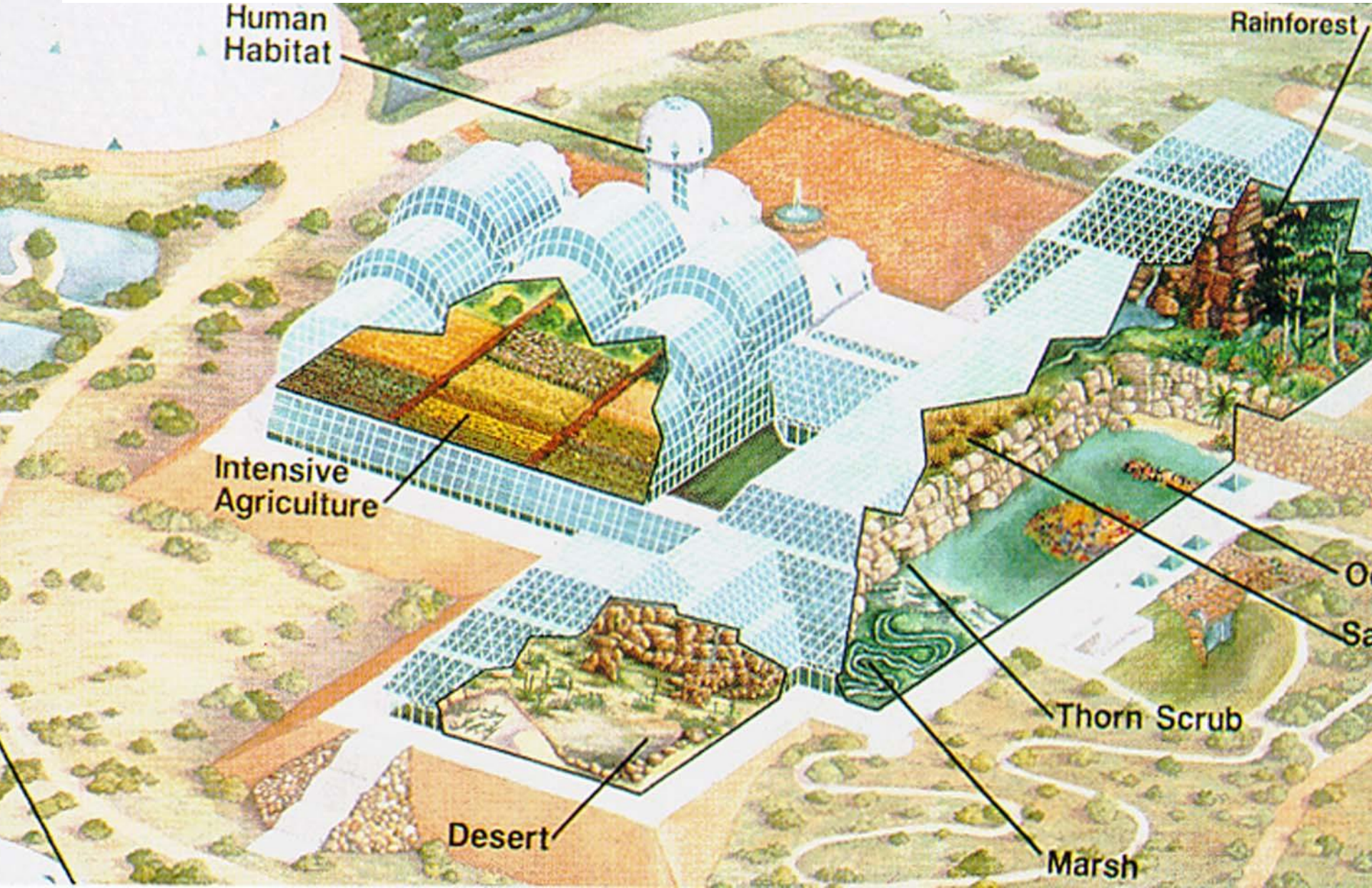


Main structure of Biosphere 2, 30 miles north of Tucson.

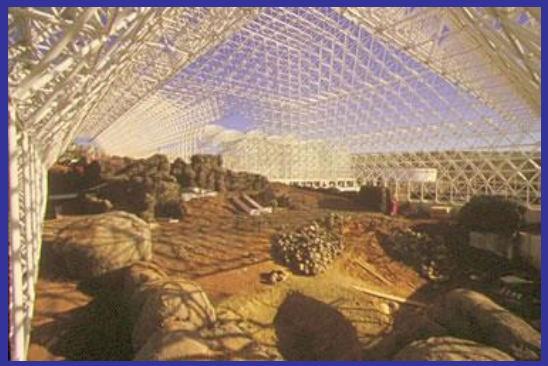


The view of Biosphere 2 from the abandoned living quarters.

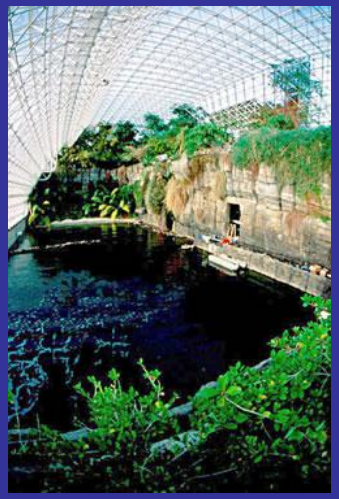
为了尽量贴近自然环境，该圈中的土壤、草皮、海水、
均取自外界的不同地理区间，通过一定的人工处理再利



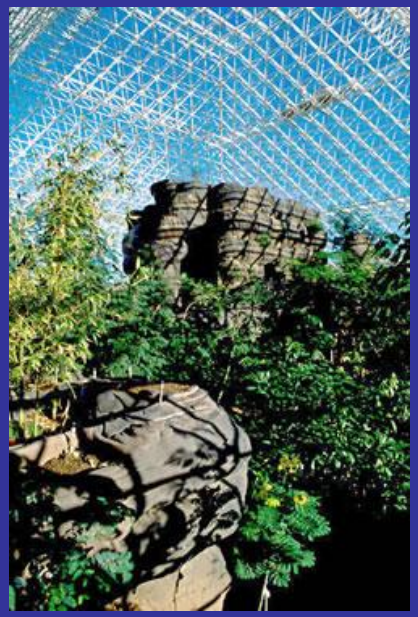
Desert

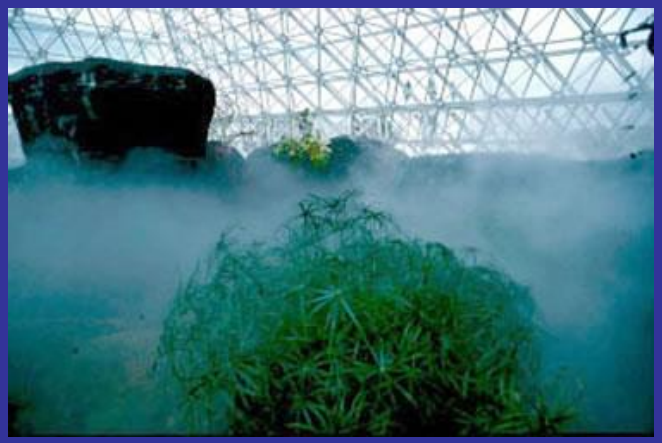


The Ocean

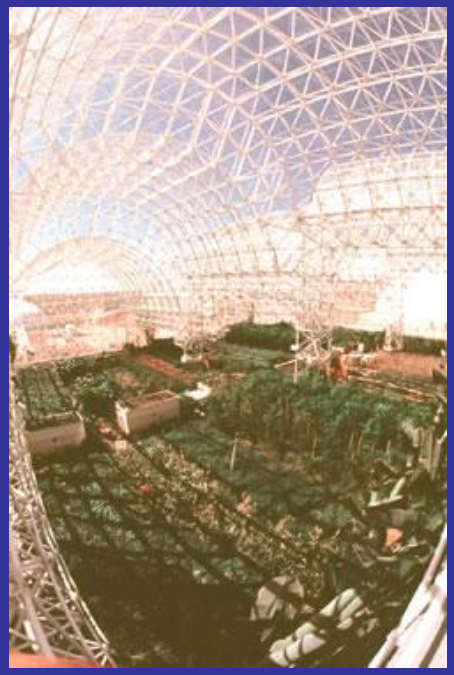


The rainforest





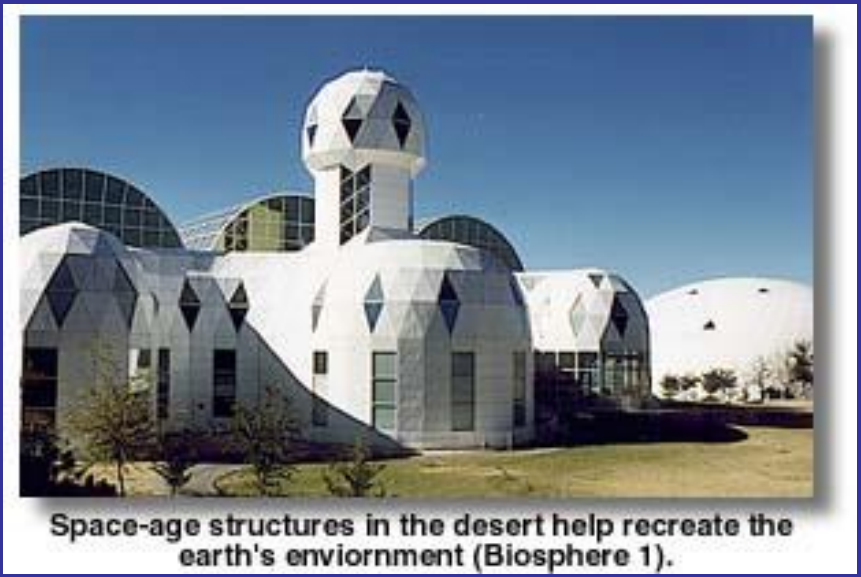
Agricultural Biome



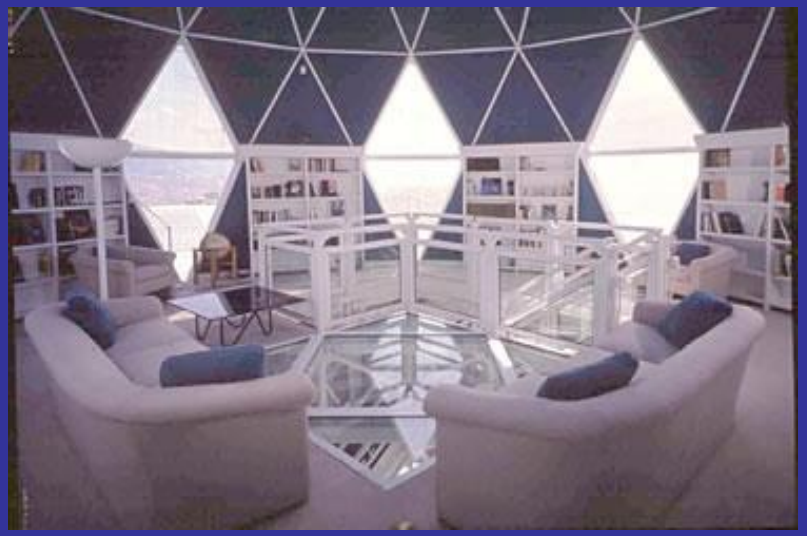
The Marshes

The Savanna and Thurnscrub

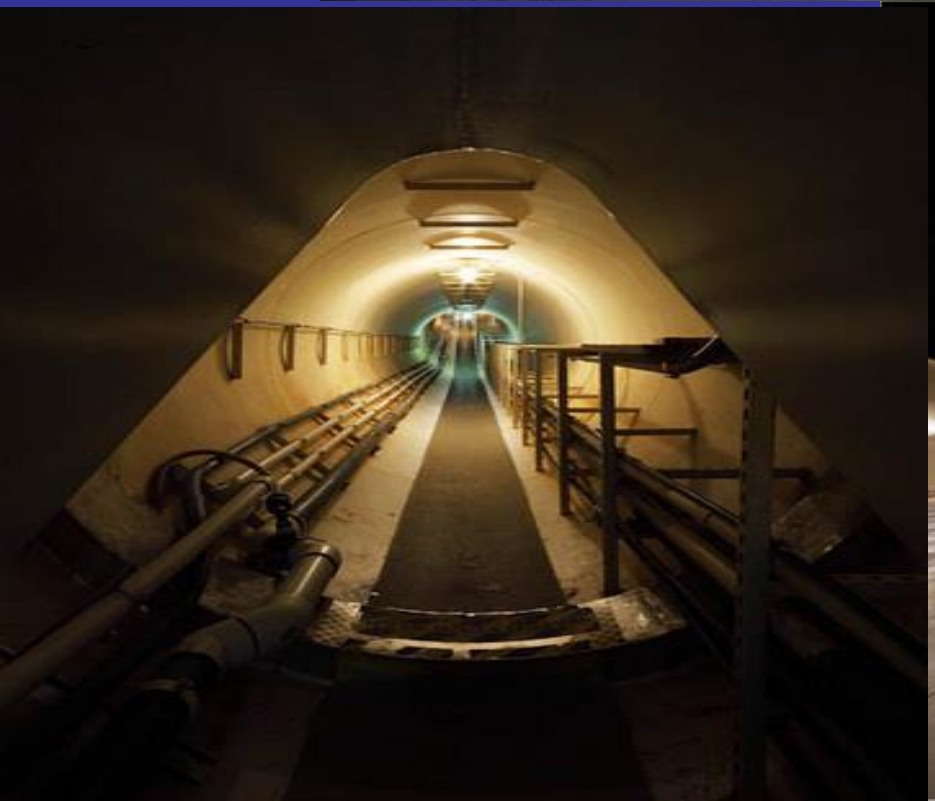
The Habitat



Space-age structures in the desert help recreate the earth's enviornment (Biosphere 1).



人工“肺”



The crew

Biosphere 2 results

在1991至1993年的实验中，研究人员发现：

- 生物圈2号的氧气与二氧化碳的大气组成比例，无法自行达到平衡；
- 生物圈2号内的水泥建筑物影响到正常的碳循环；
- 多数动植物无法正常生长或生殖，其灭绝的速度比预期的还要快。

生物圈2号计划实验目标并未达成，但是这也给人类上了很好的一课：

- 大自然并非我们想象得那样简单，复杂巨大的系统关联中，可能每一缕轻风都是于生命所不可或缺；

- 人不是万能的，人类要依赖地球生态系统的服务功能存活；人类要懂得顺应自然，要珍爱大自然的一切，才能与地球万物持续发展！

New mission (1994-2003)

1994年，巴斯将生物圈2号交由美国哥伦比亚大学管理

哥伦比亚大学开始将生物圈2号既存的生态系统仿真实验及新的研究计划整合于一体并对外界开放，做为研究及学习中心

做为全球生态学、环境变迁研究及教学的基地,以探索我们人类生活与环境生态的互动影响。

Biosphere 2 现状

- 2007年开始，University of Arizona接管Biosphere 2的教育和研究项目；
- 主要开展生态系统过程及功能对全球变化和人为活动的响应以及生态系统模型研究；
- 已获得美国NSF、NASA、私人基金委的经

Break for 5 minutes

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全球变化的主要表现

①二氧化碳浓度提高：280ppm（1850）→ 400ppm；

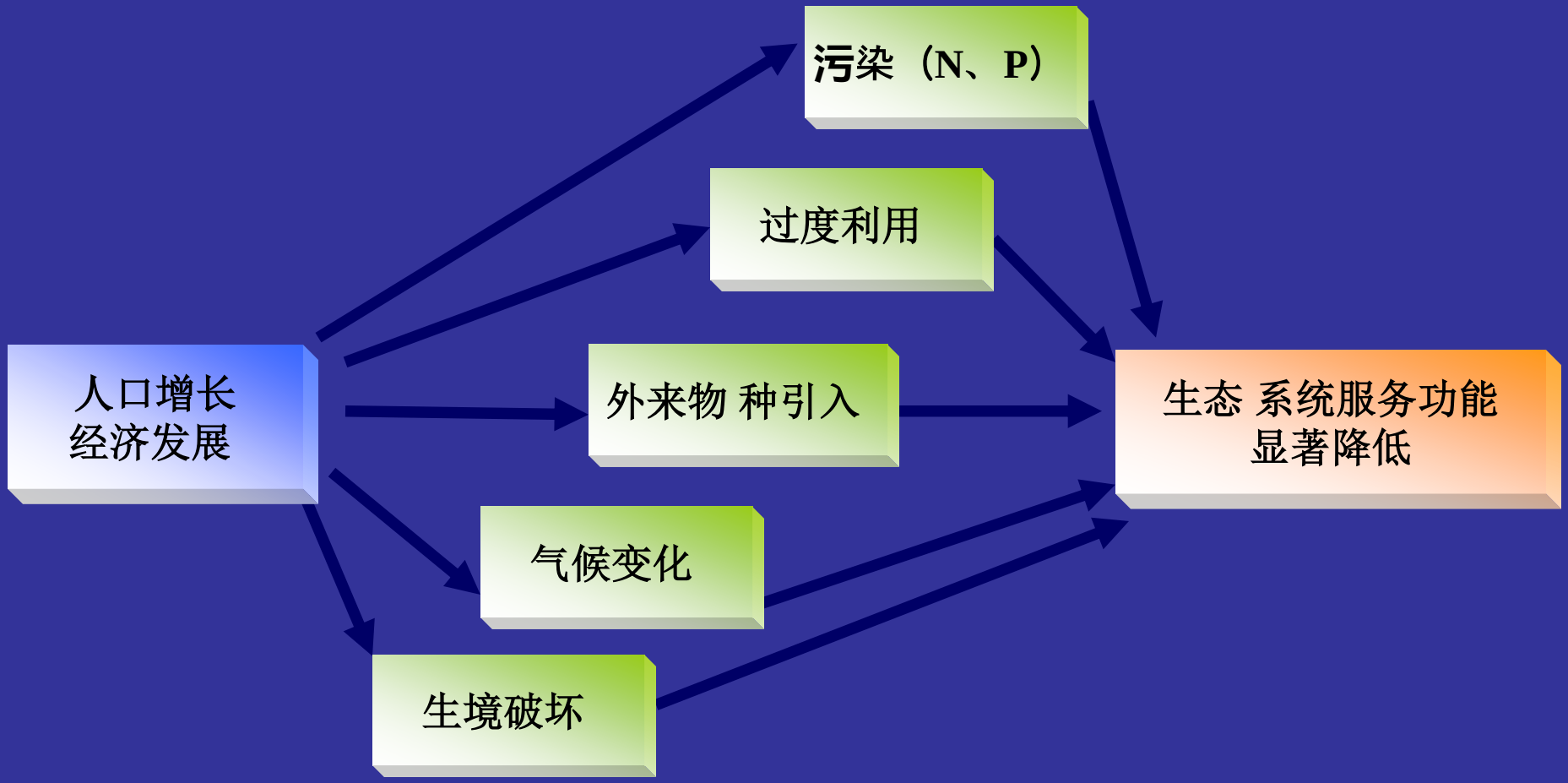
②全球变暖：已是不争的事实！

③生物地球化学循环的改变：人工固氮的总量已经超过了天然固氮总量；人类利用的地表淡水，已经超过可用总量的二分之一；

④土地覆盖与利用的改变：有三分之一到二分之一的陆地面积已经被人类活动所改变

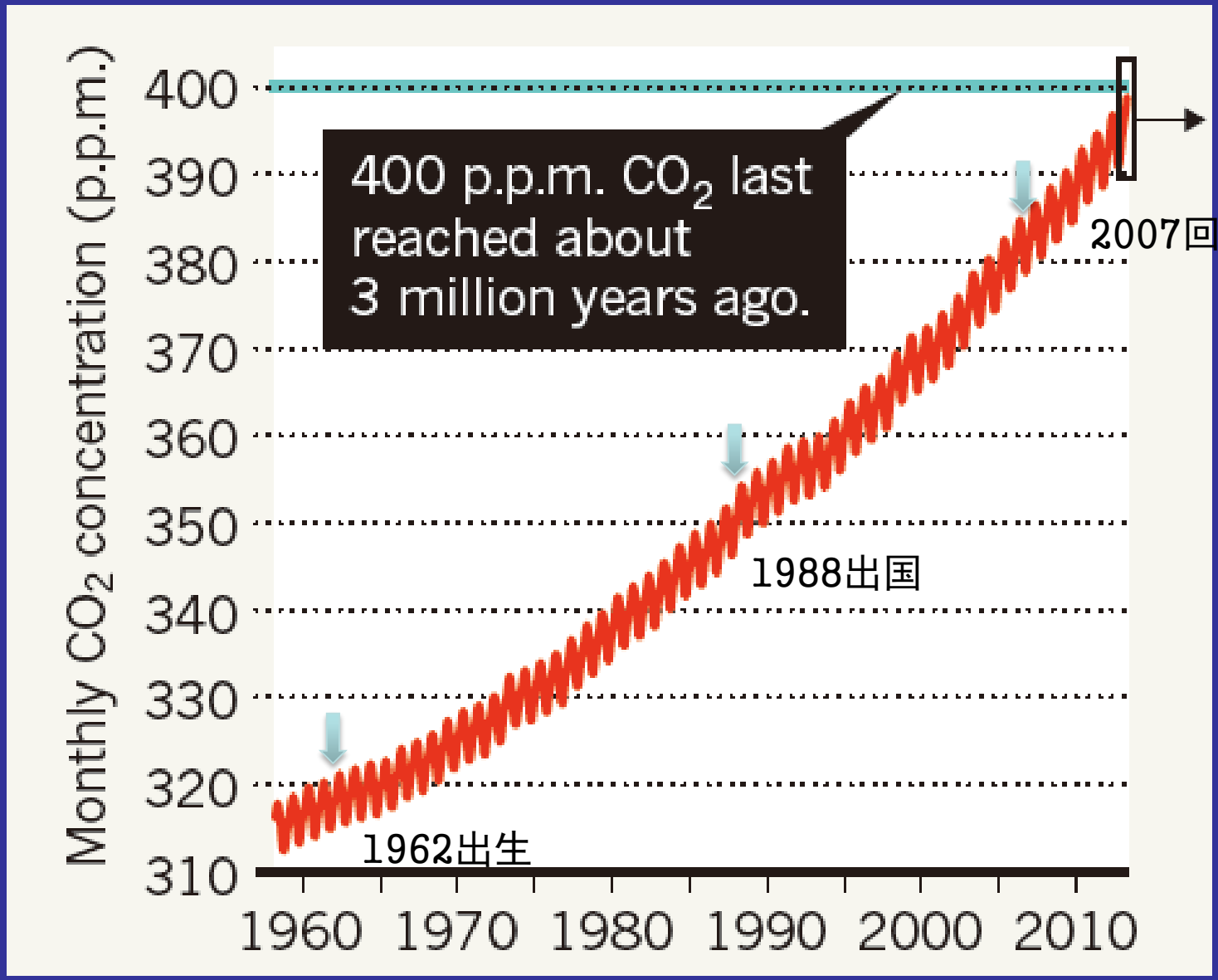
⑤生物入侵与物种丧失：近二千年来，地球上大概有四分之一的鸟类物种已经灭绝；接近三分之二的海洋渔业资源已经过捕或耗尽。

影响生态系统服务功能的驱动力



联合国，2005 《千年生态系统评估报告》

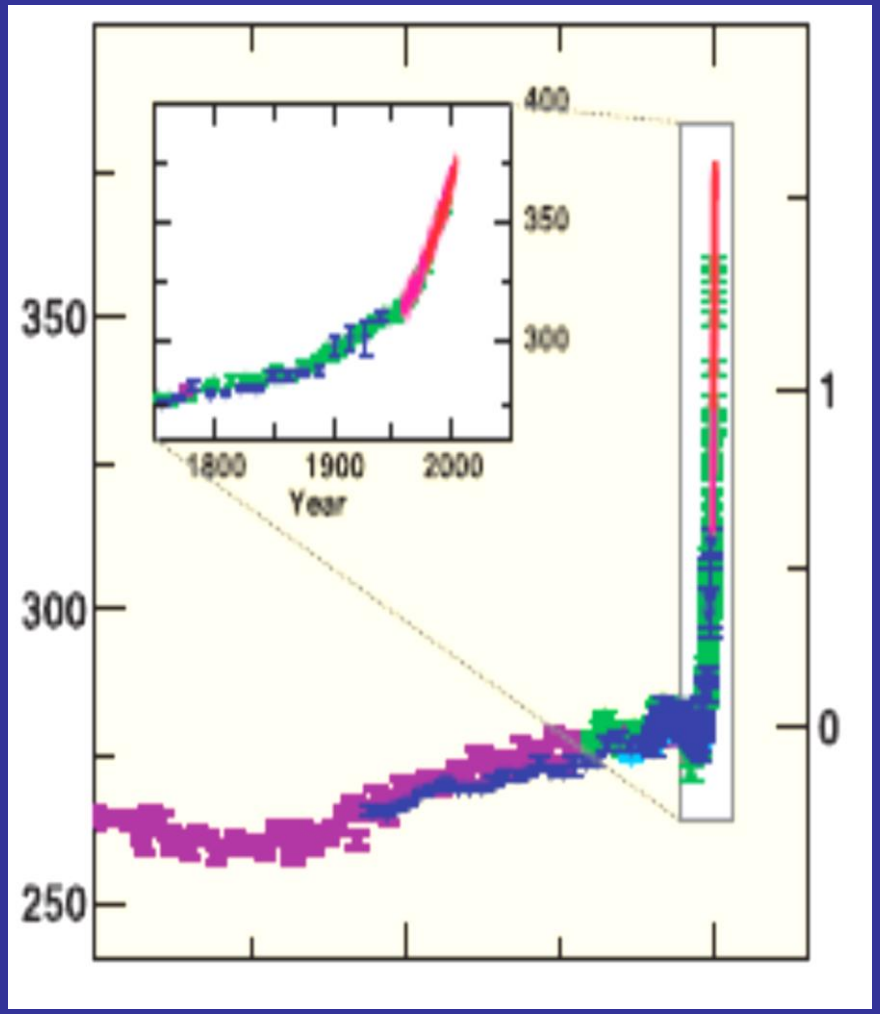
我们已进入400 ppm时代！



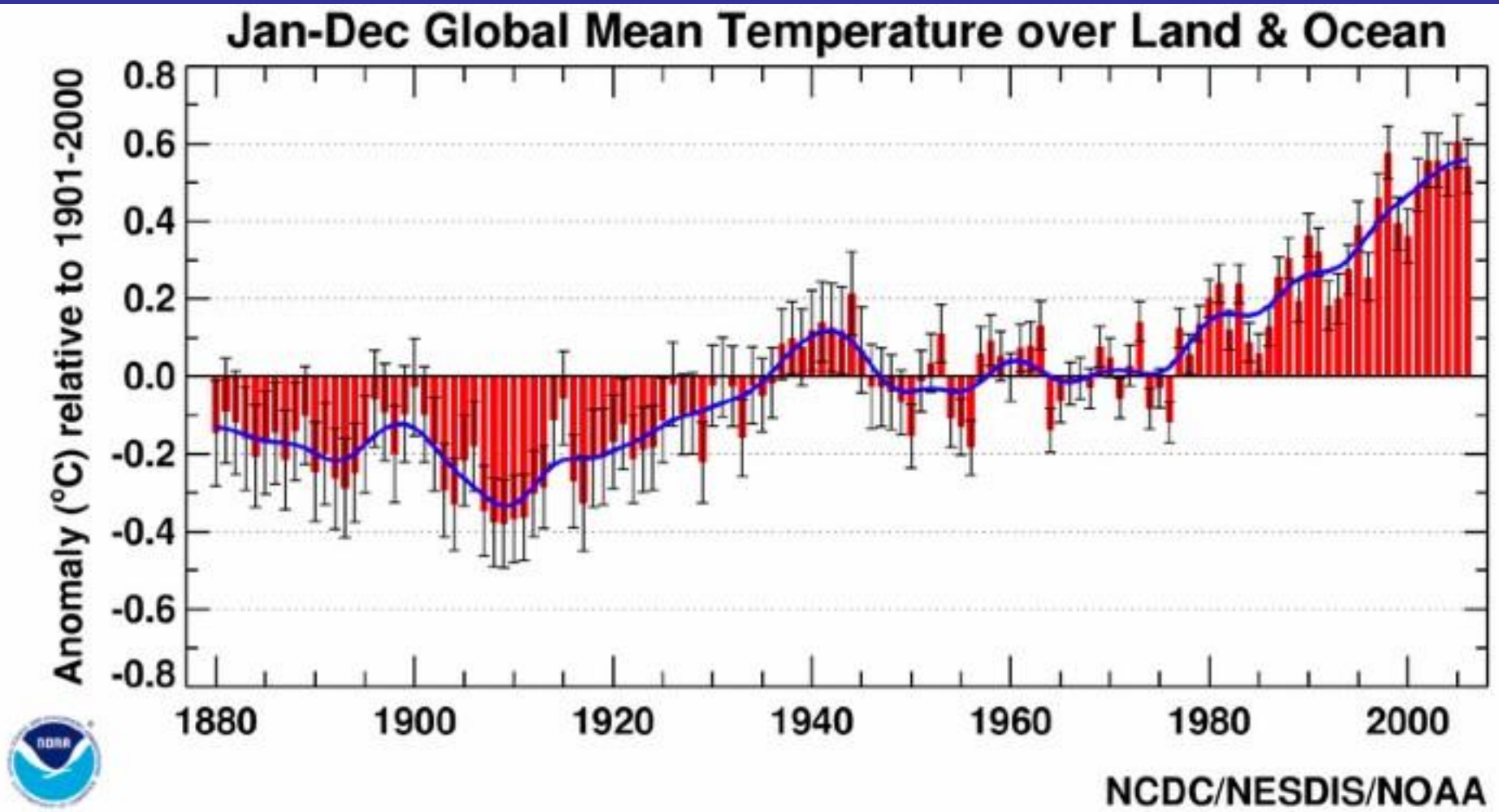
(Richard 2013, Nature)

人类活动对气候变化的影响

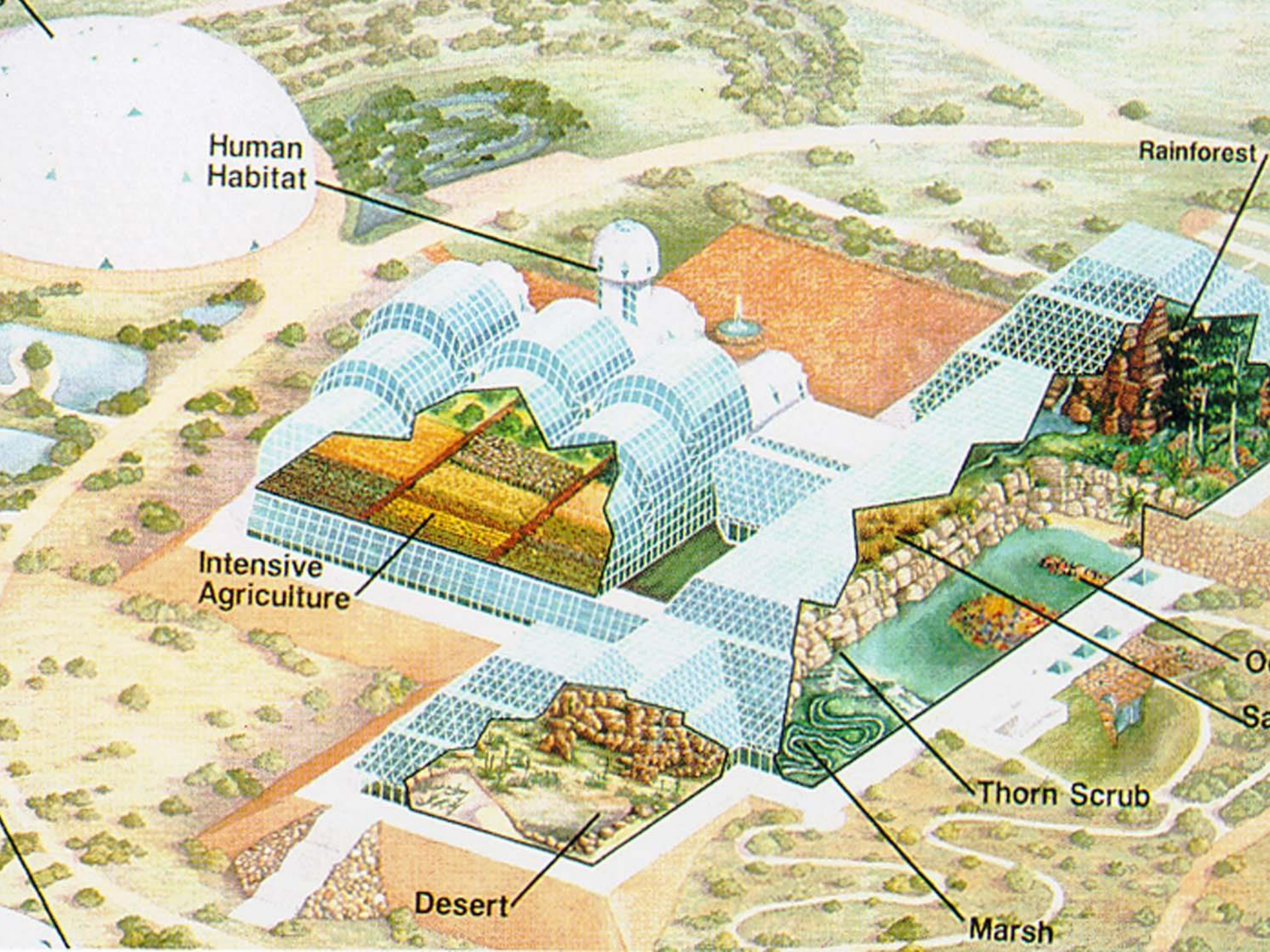
通过冰芯和观测数据分析得到的CO_2浓度变化趋势

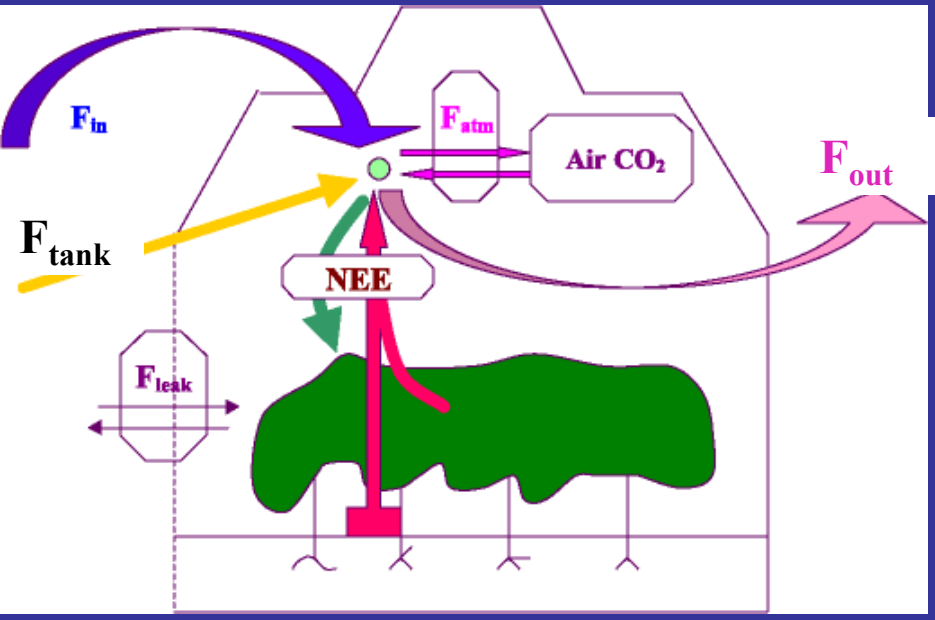


IPCC 2007



http://www.ncdc.noaa.gov/img/climate/research/2006/ann/glob_jan-dec-error-bar_pg.gif


Human Habitat
Rainforest
Intensive Agriculture
Thorn Scrub
Desert
Marsh

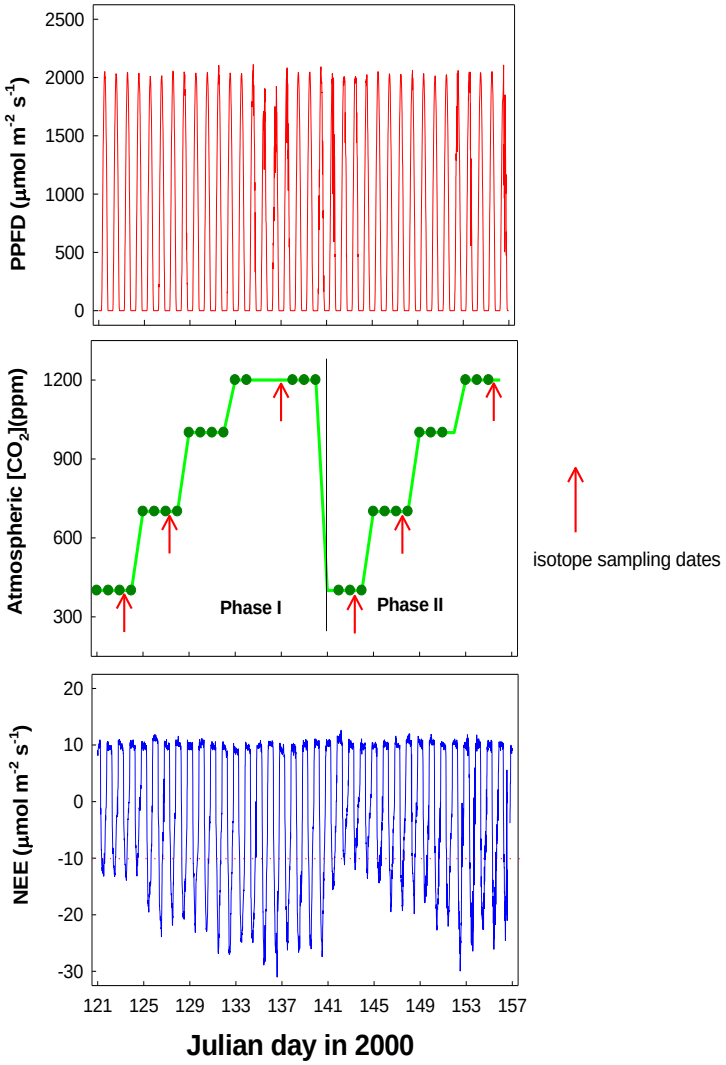


$$NEE = F_{in} + F_{tank} - F_{out} - F_{leak} - F_{atm}$$

NEE: Net ecosystem exchange of CO_2 by the rainforest
F_{in}: CO_2 flow into the rainforest from outside air
F_{out}: CO_2 flow out from the rainforest
F_{leak}: Net CO_2 leak across the partition curtain
F_{tank}: CO_2 added from the tank
F_{atm}: Net CO_2 accumulated in the inside atmosphere

$$GPP = NEE + R_{eco}$$

GPP: Gross photosynthetic productivity
R_{eco}: Ecosystem respiration rate



Lin et al. 1998, AJPP; Lin et al. 1999, Oecologia; Griffin, Lin et al. 2001 PNAS; Osmond, Lin et al. 2004, Global Change Biology

Oecologia (1999) 119:97–108

Guanghui Lin · John Adams · Blake Farnsworth
Yongdan Wei · Bruno D.V. Marino · Joseph A. Berry

Ecosystem carbon exchange in two terrestrial ecosystem mesocosms under changing atmospheric CO_2 concentrations

Griffin, K., O.R. Anderson, M.D. Gastrich, J.A. Lewis, G. Lin, W. Schuster, J. Seeman, D.T. Tissue, M.H. Turnbull, and D. Whitehead. 2001. Plant growth in elevated CO_2 alters mitochondrial number and chloroplast fine structure. PNAS 98: 2473-2478.

New Phytologist

Research

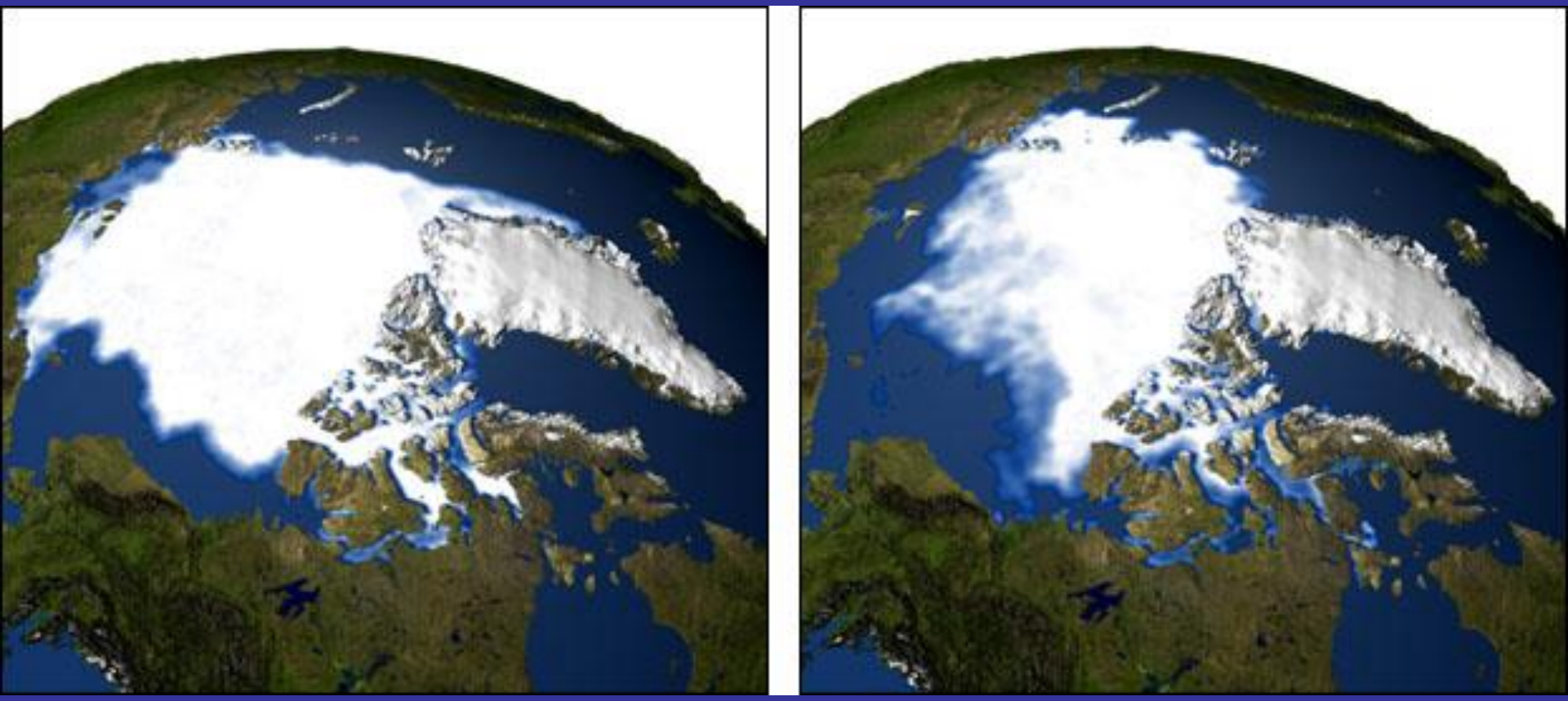
Rapid report

Leaf respiratory CO_2 is ^{13}C-enriched relative to leaf organic components in five species of C_3 plants

Author for correspondence:
Cheng-yuan Xu
Tel: +(845) 3658995

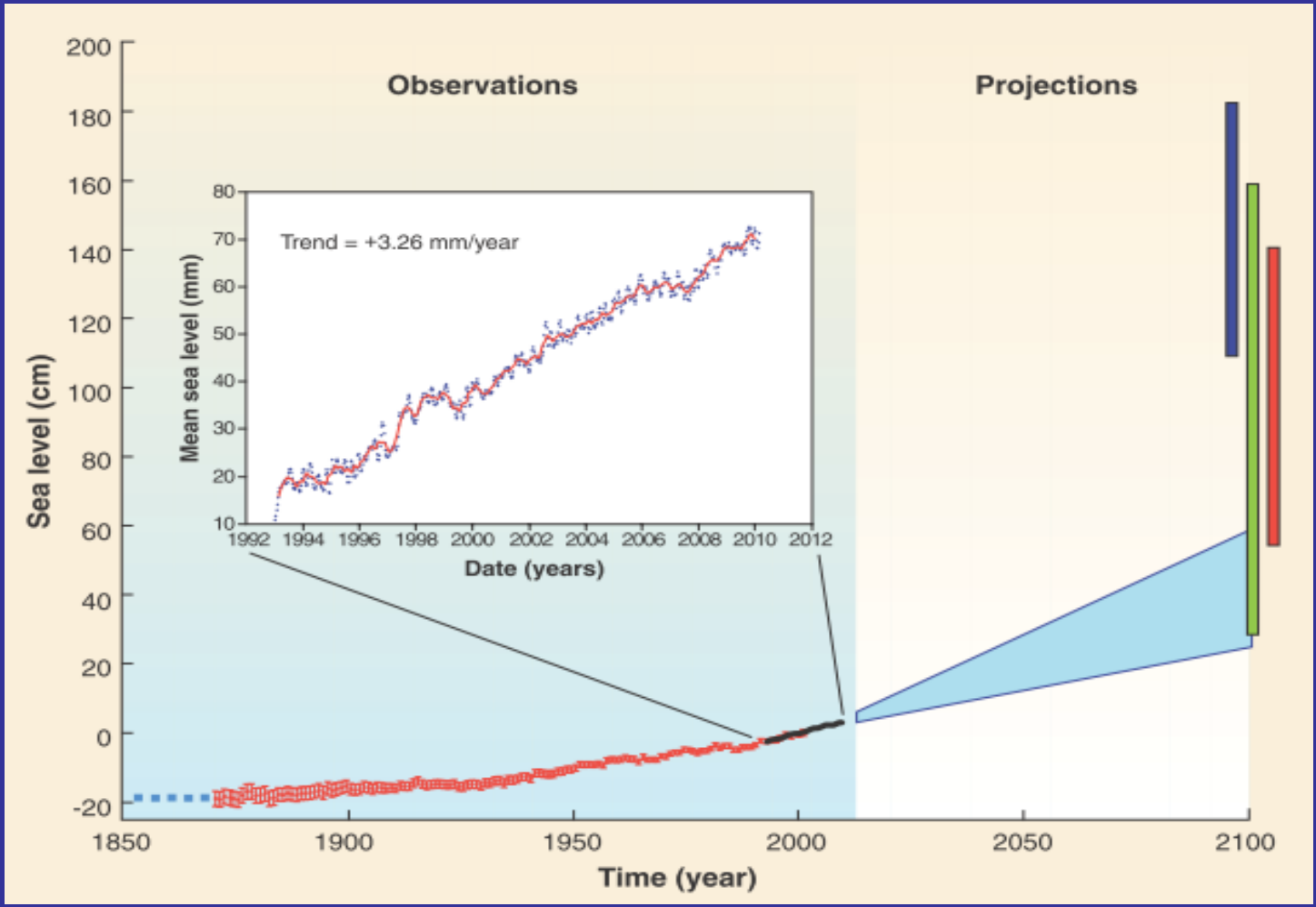
Cheng-yuan Xu[1,2], Guang-hui Lin[2,3*], Kevin L. Griffin[1] and Raymond N. Sambrotto[1]

1979 冰川融化 2003



NASA photographs indicate a 3% decrease per decade in arctic sea ice extent.

海平面上升

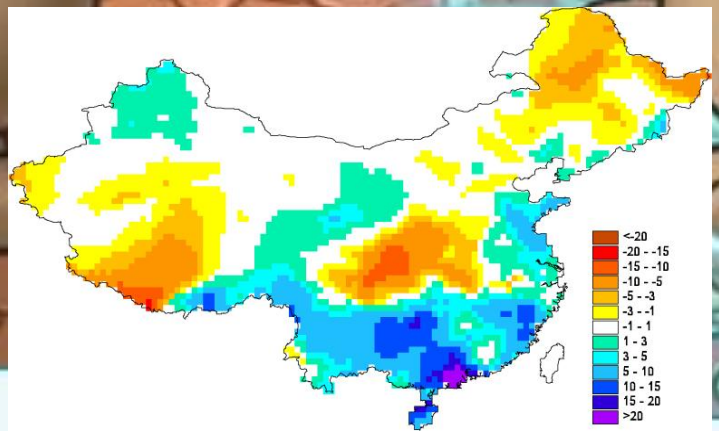


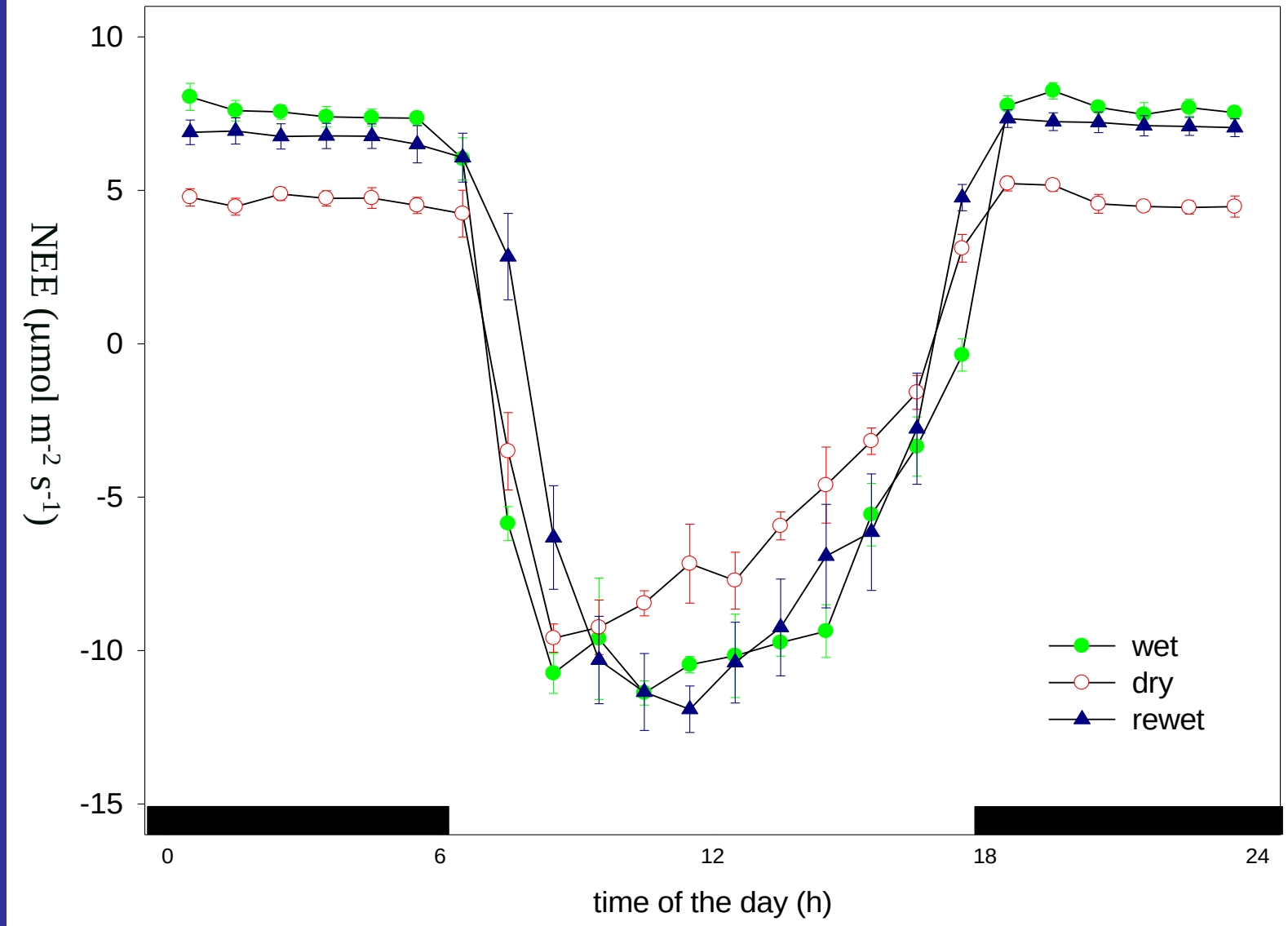
Robert J. Nicholls *et al*., Science 2010

More frequent extreme weather!

极端气候更加频繁！

Dryer in the North, wetter in the South





Rascher, Lin et al. 2004, Plant, Cell and Environment
Pegoraro, Lin et al. 2005, 2006, Global Change Biology

Plant, Cell and Environment (2004) 27, 1239–1256

Functional diversity of photosynthesis during drought in a model tropical rainforest – the contributions of leaf area, photosynthetic electron transport and stomatal conductance to reduction in net ecosystem carbon exchange

U. RASCHER[1,2,4§], E. G. BOBICH[1,*,†], G. H. LIN[1,3,*,‡], A. WALTER[1,2,*], T. MORRIS[1], M. NAUMANN[5], C. J. NICHOL[1,6], D. PIERCE[1], K. BIL[1], V. KUDEYAROV[7] & J. A. BERRY[3]

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Agricultural and Forest Meteorology 119 (2003) 53–68

AGRICULTURAL AND FOREST METEOROLOGY

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Partitioning overstory and understory evapotranspiration in a semiarid savanna woodland from the isotopic composition of water vapor

Enrico A. Yepez[a,*], David G. Williams[a,1], Russell L. Scott[b], Guanghui Lin[c]

Global Change Biology (2002) 8, 479–485

Leaf respiration is differentially affected by leaf vs. stand-level night-time warming

KEVIN L. GRIFFIN*, MATTHEW TURNBULL†, RAMESH MURTHY‡, GUANGHUI LIN‡, JOHN ADAMS‡, BLAKE FARNSWORTH‡, TILAK MAHATO‡, GUERRIC BAZIN§, MARK POTASNAK[1] and JOE A. BERRY¶

Global Change Biology (2005) 11, 1234–1246, doi: 10.1111/j.1365-2486.2005.00986.x

The effect of elevated atmospheric CO_2 and drought on sources and sinks of isoprene in a temperate and tropical rainforest mesocosm

EMILIANO PEGORARO*[1], LEIF ABRELL*[2], JOOST VAN HAREN*[3], GREG BARRON-GAFFORD*[4], KATHERINE ANN GRIEVE*[5], YADVINDER MALHI†, RAMESH MURTHY*[6] and GUANGHUI LIN*‡[7]

Global Change Biology (2006) 12, 456–469, doi: 10.1111/j.1365-2486.2006.01112.x

Drought effect on isoprene production and consumption in Biosphere 2 tropical rainforest

EMILIANO PEGORARO*[1], ANA REY[1], LEIF ABRELL*[2], JOOST VANHAREN*[3] and GUANGHUI LIN*†[4]

Global Change Biology (2004) 10, 393–407, doi: 10.1111/j.1529-8817.2003.00747.x

OPINION

Changing the way we think about global change research: scaling up in experimental ecosystem science

BARRY OSMOND*, GENNADY ANANYEV†[1], JOSEPH BERRY*‡ CHRIS LANGDON*, ZBIGNIEW KOLBER †§, GUNGHUI LIN*‡, RUSSELL MONSON*¶, CAROLINE NICHOL*‖, UWE RASCHER*‡, ULI SCHURR**, STAN SMITH†† and DAN YAKIR*‡‡


2003年回国后---
1、草原
（土地利用改变）
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Province-level boundary
National capital
Province-level capital
Railroad
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Autonomous regions and municipalities in italics.
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Kashi
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AFG.
PAK.
Indian claim
Line of Control
Chinese line of control
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Ledo
BURMA
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Rangoon
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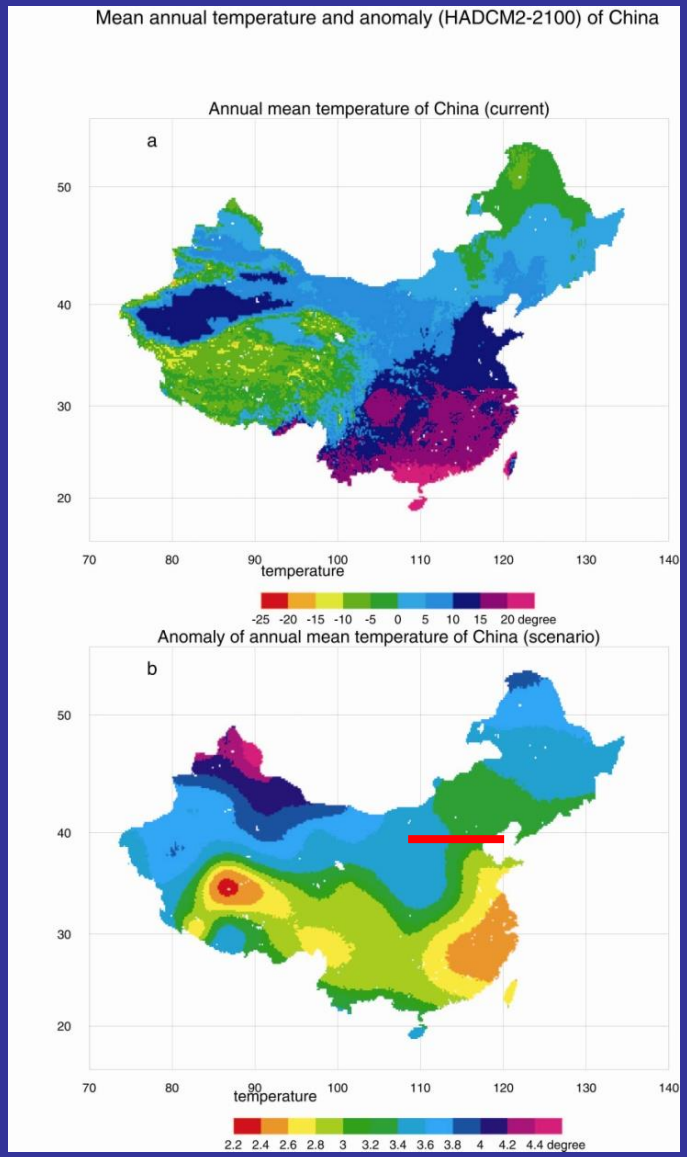
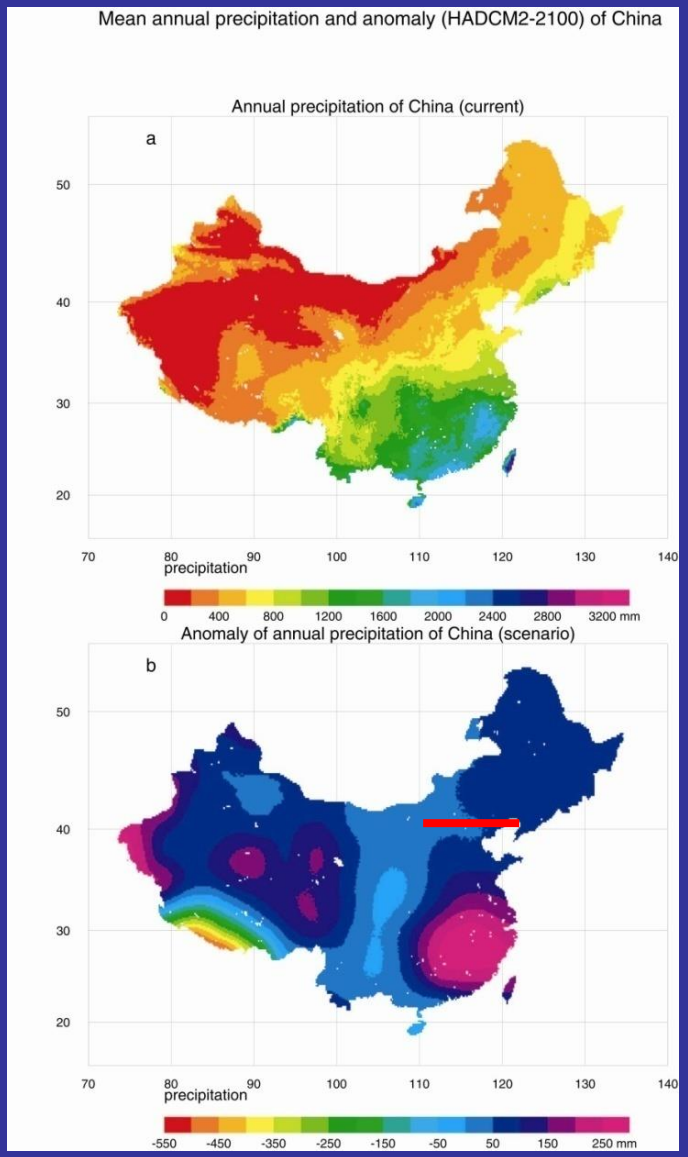
农垦、退耕还草

未来气候变化





Ni et al. 2002

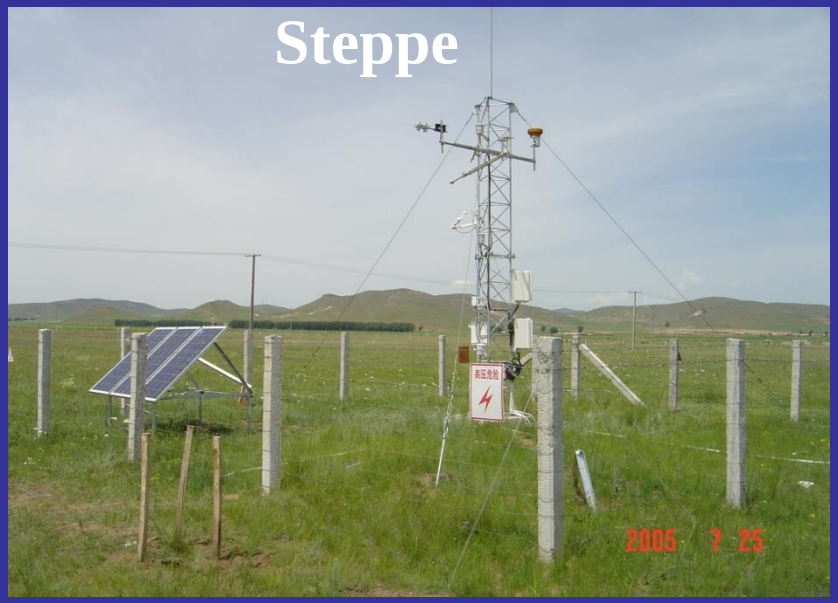
科学问题

- 土地利用改变和气候变化如何影响到我国干旱、半干旱地区生态系统的碳、水循环？
- 人为活动和气候变化因子之间对我国北方草原生态系统结构与功能的影响是否具有协同作用？
- 干旱、半干旱地区生态系统哪些过程对人为活动和气候变化最为敏感？

中国科学院”百人计划”资助课题

Duolun (agro-pasture transit area)

Steppe



Location: 116°17′01″ E, 42°02′48″ N

Vegetation height: 30-50 cm

Dominant species: *Stipa krylovii*,

Artemisia frigida

Land use type: fenced since 2001

Tower established in May 2005 (5m tall)

Cropland

Location: 116°16′47″ E, 42°02′44″ N

Vegetation height: 80-100 cm

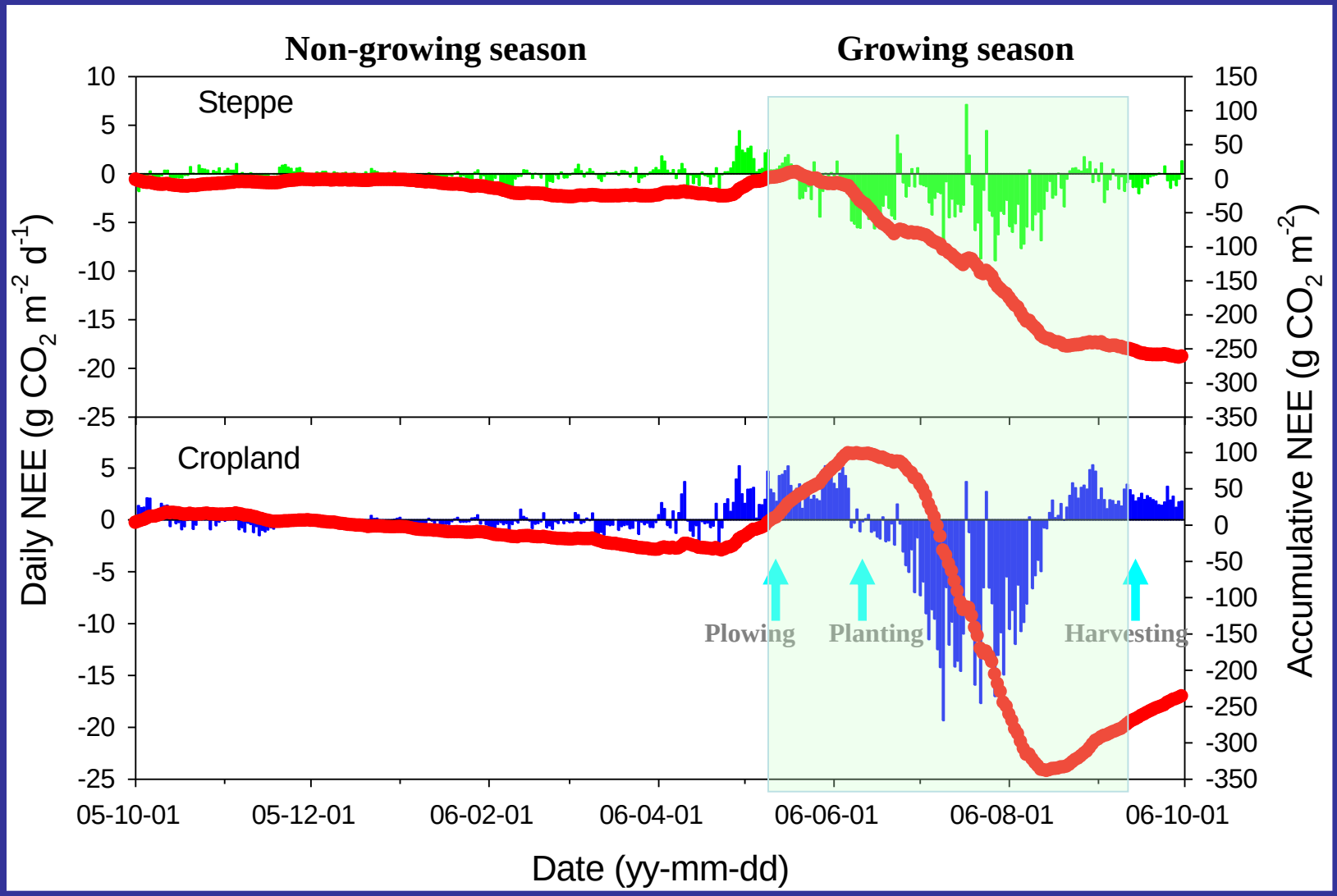
Dominant species: *Triticum aestivum*

Fagopyrum esculentum

Land use type: reclaimed about 35 years

Tower established in May 2005 (5 m tall)

NEE comparison (Oct 05-Sept 06, Duolun)



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AGRICULTURAL AND FOREST METEOROLOGY
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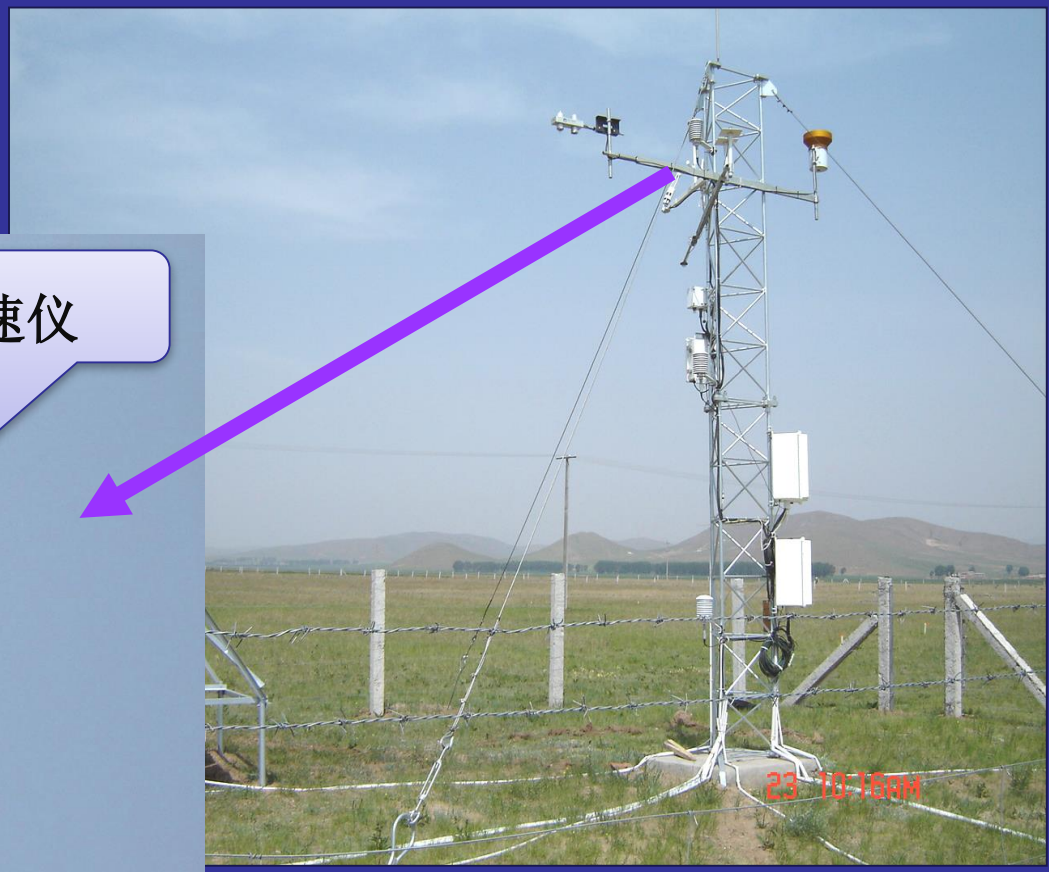
Biophysical regulations of carbon fluxes of a steppe and a cultivated cropland in semiarid Inner Mongolia

W.L. Zhang [a,b], S.P. Chen [a], J. Chen [a,c], L. Wei [a,b], X.G. Han [a], G.H. Lin [a,*]

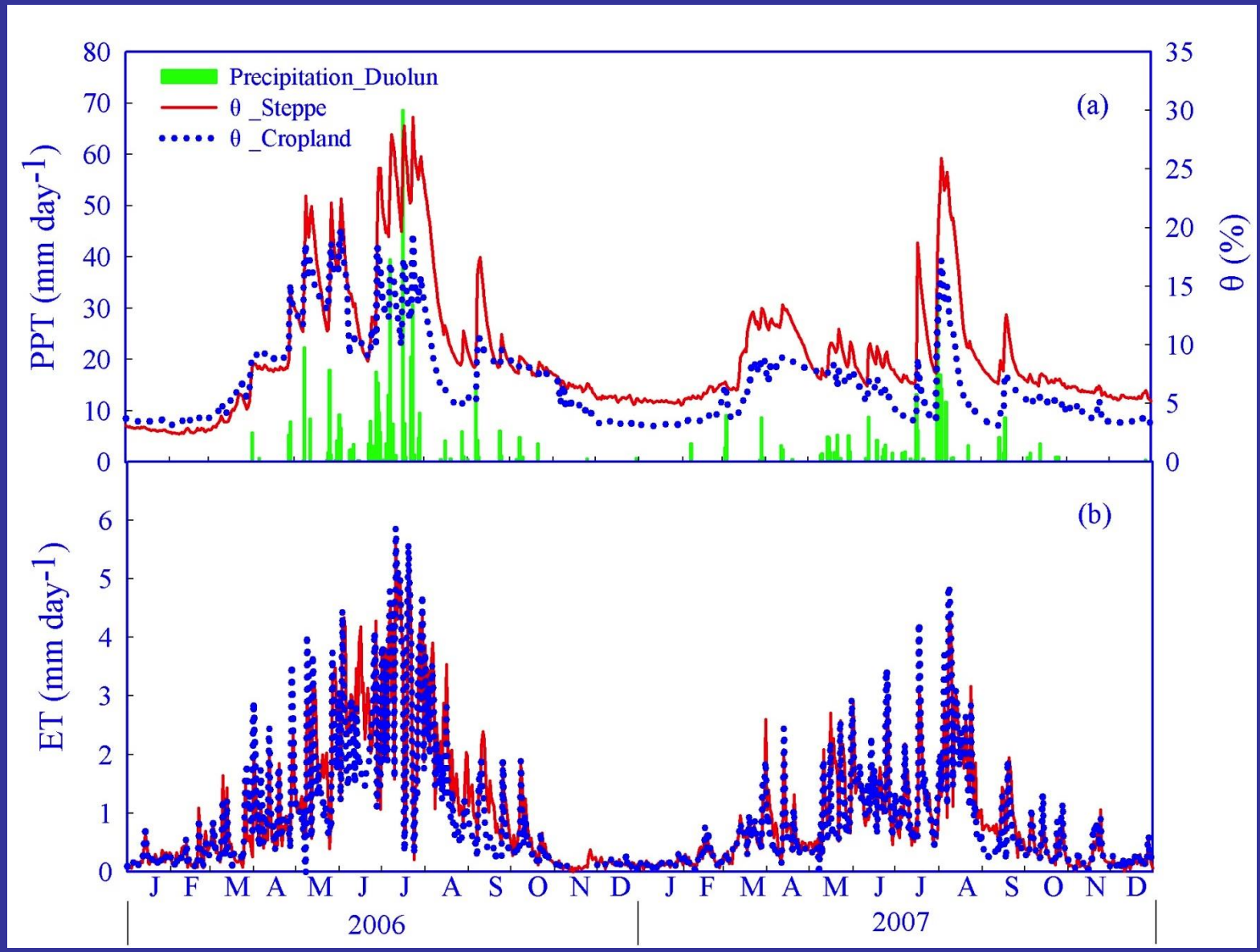
[a] *Key Laboratory Vegetation and Environmental Change, Institute of Botany, the Chinese Academy of Sciences, No. 20 Nanxincun, Xiangshan, Beijing 100093, China*
[b] *Graduate University of Chinese Academy of Sciences, Beijing 100049, China*
[c] *Department of Environmental Sciences, University of Toledo, Toledo, OH 43606, USA*

Received 10 August 2006; received in revised form 6 June 2007; accepted 7 June 2007

蒸发散(ET) 测定方法-涡度协方差技术

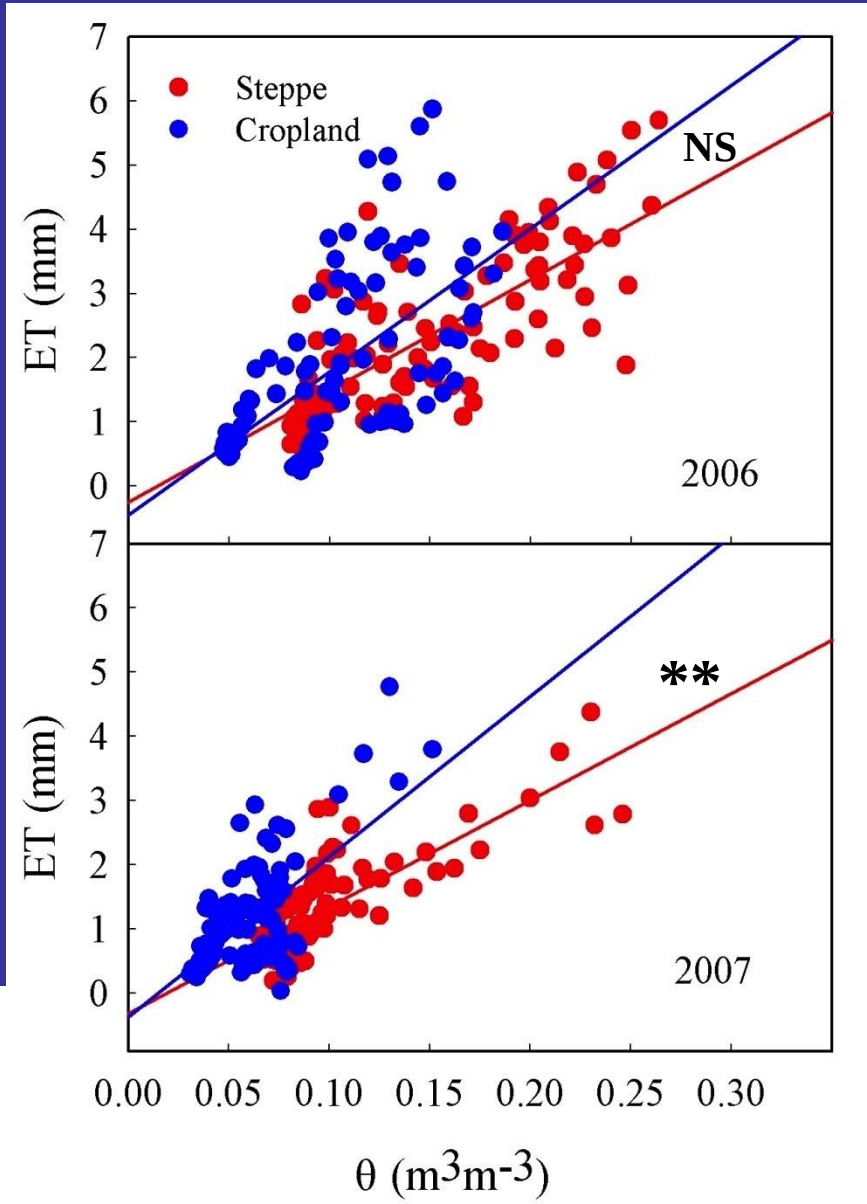


Duolun


Precipitation_Duolun
θ _Steppe
θ _Cropland
(a)
(b)
PPT (mm day-1)
ET (mm day-1)
θ (%)
J F M A M J J A S O N D J F M A M J J A S O N D
2006
2007

蒸发散与土壤含水量的关系

Duolun



Agricultural and Forest Meteorology 149 (2009) 1810–1819

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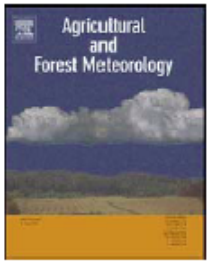

Cultivation and grazing altered evapotranspiration and dynamics in Inner Mongolia steppes

Haixia Miao [a,b], Shiping Chen [a], Jiquan Chen [c], Wenli Zhang [a,d], Ping Zhang [a,b], Long Wei [a,b], Xingguo Han [a], Guanghui Lin [a,*]

[a] State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China
[b] Graduate University of the Chinese Academy of Sciences, Beijing 100049, China
[c] Department of Environmental Sciences, University of Toledo, Toledo, OH 43606, USA
[d] College of Chemistry and Life Science, China Three Gorges University, YiChang, HuBei, 443002, China

中国科学院“百人计划”资助课题
中国科学院“知识创新工程重要方向”项目
国家自然科学基金面上项目

多因子处理

Global Change Biology

Global Change Biology (2009) 15, 2450–2461, doi: 10.1111/j.1365-2486.2009.01879.x

Dependence of carbon sequestration on the differential responses of ecosystem photosynthesis and respiration to rain pulses in a semiarid steppe

SHIPING CHEN*, GUANGHUI LIN*, JIANHUI HUANG* and G. DARREL JENERETTE†

State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China, †Department of Botany and Plant Sciences, University of California, Riverside, CA 92521-0124, USA

Global Change Biology

Global Change Biology (2010) 16, 2345–2357, doi: 10.1111/j.1365-2486.2009.02091.x

Differential responses of auto- and heterotrophic soil respiration to water and nitrogen addition in a semiarid temperate steppe

LIMING YAN*†, SHIPING CHEN*, JIANHUI HUANG* and GUANGHUI LIN*

State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China, †Graduate University of Chinese Academy of Sciences, Beijing 100049, China


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AFG.
PAK.
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Line of Control
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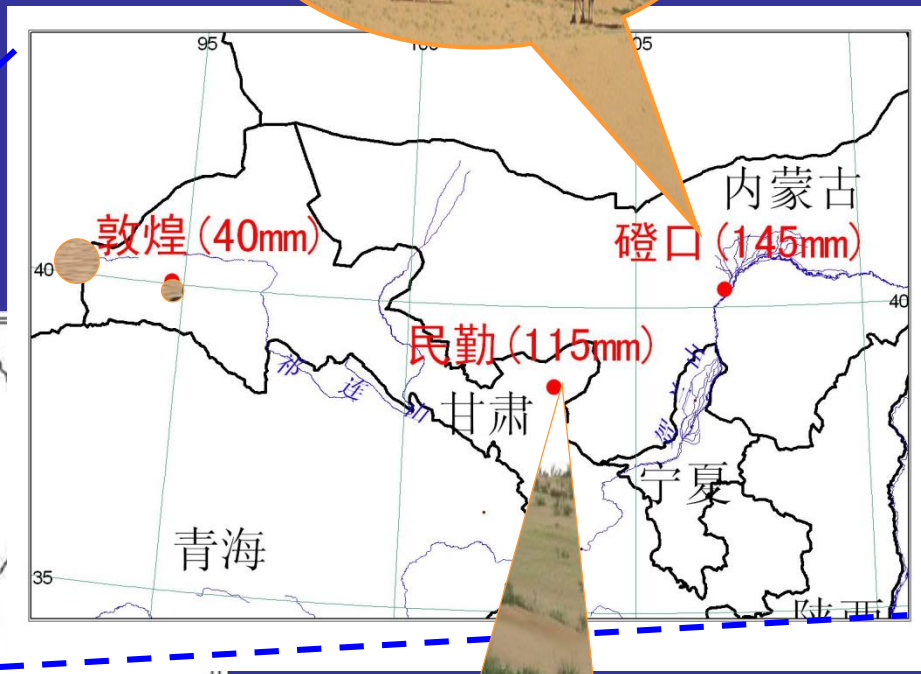
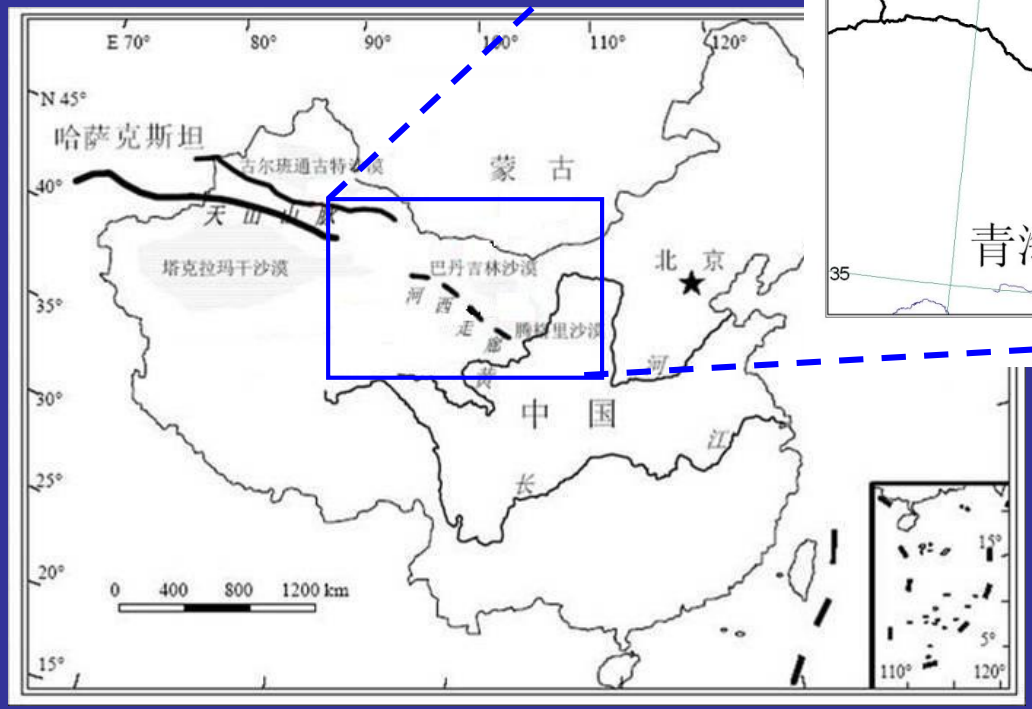
Study sites in Inner Mongolia and Gansu



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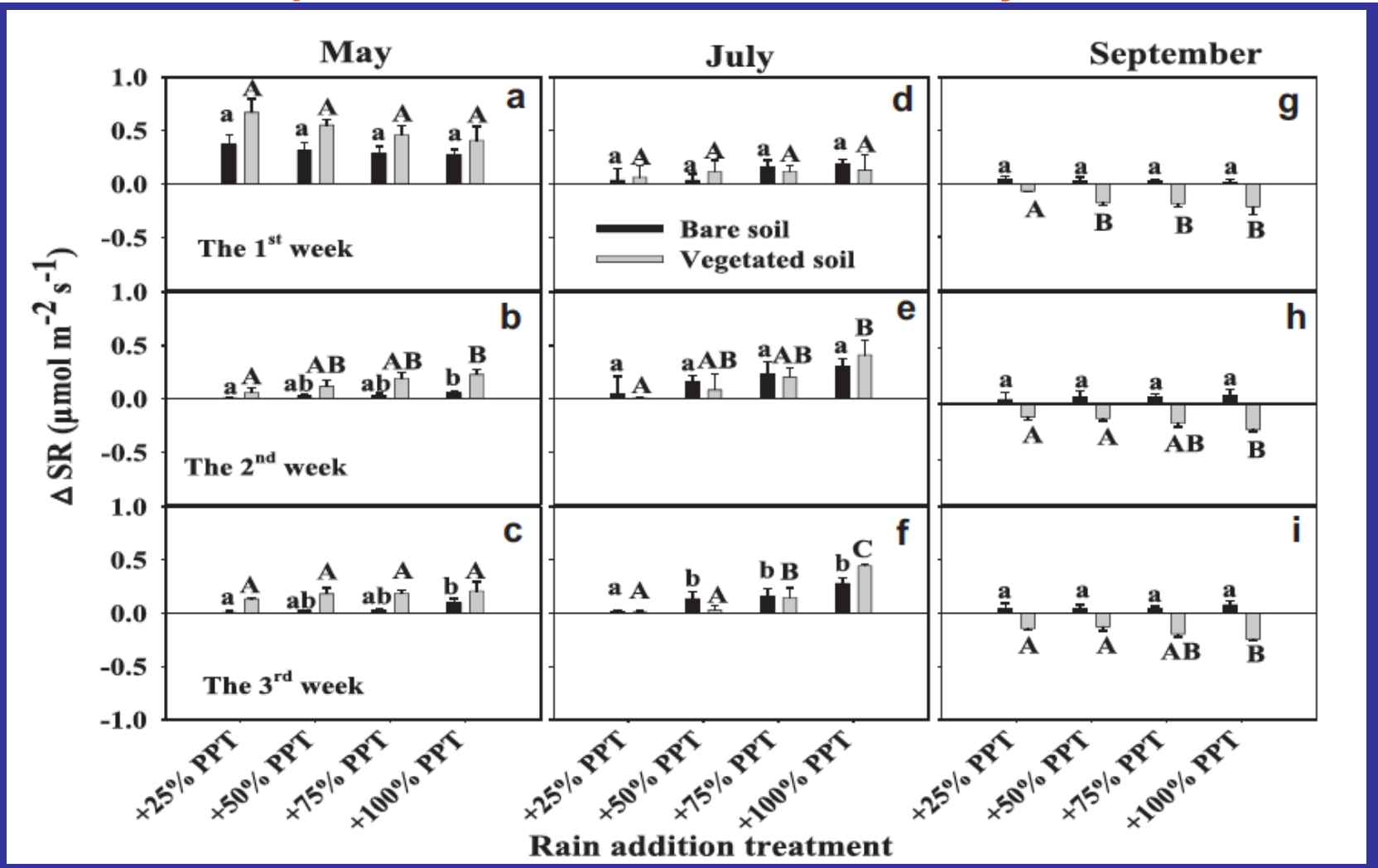
Vegetation cover and rain timing co-regulate soil respiration in a desert ecosystem



Soil Biology & Biochemistry 2012

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journal homepage: www.elsevier.com/locate/soilbio

Vegetation cover and rain timing co-regulate the responses of soil CO_2 efflux to rain increase in an arid desert ecosystem

Weimin Song[a,b], Shiping Chen[a], Bo Wu[c], Yajuan Zhu[c], Yadan Zhou[a,b], Yonghua Li[c], Yanli Cao[c], Qi Lu[c], Guanghui Lin[d,*]


2003年回国后---
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2、荒漠
（气候变化）
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（极端气候、生物入侵）
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East China Sea
South China Sea

海岸湿地具有丰富的生态服务功能

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- 促淤保滩
- 维持生物多样性
- 生物量生产
- 固碳释氧
- 净化水质
- 休闲娱乐
- …

Biodiversity Loss and Bio-invasion

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Tuesday, 21 May, 2002, 13:48 GMT 14:48 UK

Quarter of mammals 'face extinction'

Siberian tigers may vanish within three decades

By Corinne Podger
BBC science correspondent

Almost a quarter of the world's mammals face ex
a Unite
global e

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Last Updated: Thursday, 18 September, 2003, 12:04 GMT 13:04 UK

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Lions 'close to extinction'

Lion populations have fallen by almost 90% in the past 20 years, leaving the animal close to extinction in Africa, a wildlife expert has warned.

There are now only 23,000 left, compared to an estimated 200,000 two decades ago,

Live with them
lose them

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Study: Only 10 percent of big ocean fish remain

By Marsha Walton
CNN
Wednesday, May 14, 2003 Posted: 10:29 PM EDT (0229 GMT)

(CNN) -- A new global study concludes that 90 percent of all large fishes have disappeared from the world's oceans in the past half century, the

CNN.com/SCI-TECH

THE GREEN CENTURY | TIME

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Scientists agree world faces mass extinction

August 23, 2002 Posted: 11:43 AM EDT (1543 GMT)

By Gary Strieker
CNN

Organ Pipe Cactus National

(CNN) -- The complex web of life on Earth, what scientists call "biodiversity," is in serious trouble.

Review

Cell PRESS

Invasive species, ecosystem services and human well-being

Liba Pejchar[1] and Harold A. Mooney[2]

[1] Department of Fish, Wildlife and Conservation Biology, Colorado State University, Fort Collins, CO 80523, USA
[2] Department of Biology, Stanford University, Stanford, CA 94305, USA

Although the effects of invasive alien species (IAS) on native species are well documented, the many ways in which such species impact ecosystem services are still emerging. Here we assess the costs and benefits of IAS for provisi illustrate t these imp Africa, the and intera pose a research and policy framework for filling the remaining knowledge gaps. Drawing on ecology and economics to incorporate the impacts of IAS on ecosystem services into decision making is key to restoring and sustaining those life-support services that nature provides and all organisms depend upon.

尽管外来入侵种对乡土物种的效应已有很好的纪录，但他们对生态系统服务功能的影响在许多方面至今还鲜有研究.

In these cases, their impacts are staggering (e.g. US$14.45 billion in China) [12] but largely anecdotal and wide ranging. For example, figures for the total cost of IAS in the USA range from US$131 billion cumulative to systematic not consider IAS on eco- to monetary ture the full impact of IAS on human well-being, dimensions that go beyond monetary costs and benefits must be considered, such as the number of people affected positively or negatively by IAS and the magnitude of this impact on their lives. Policy responses to date have been based on rough estimates of ecological, social and economic damages [15].

国家自然科学基金重点项目
(2009-2012)

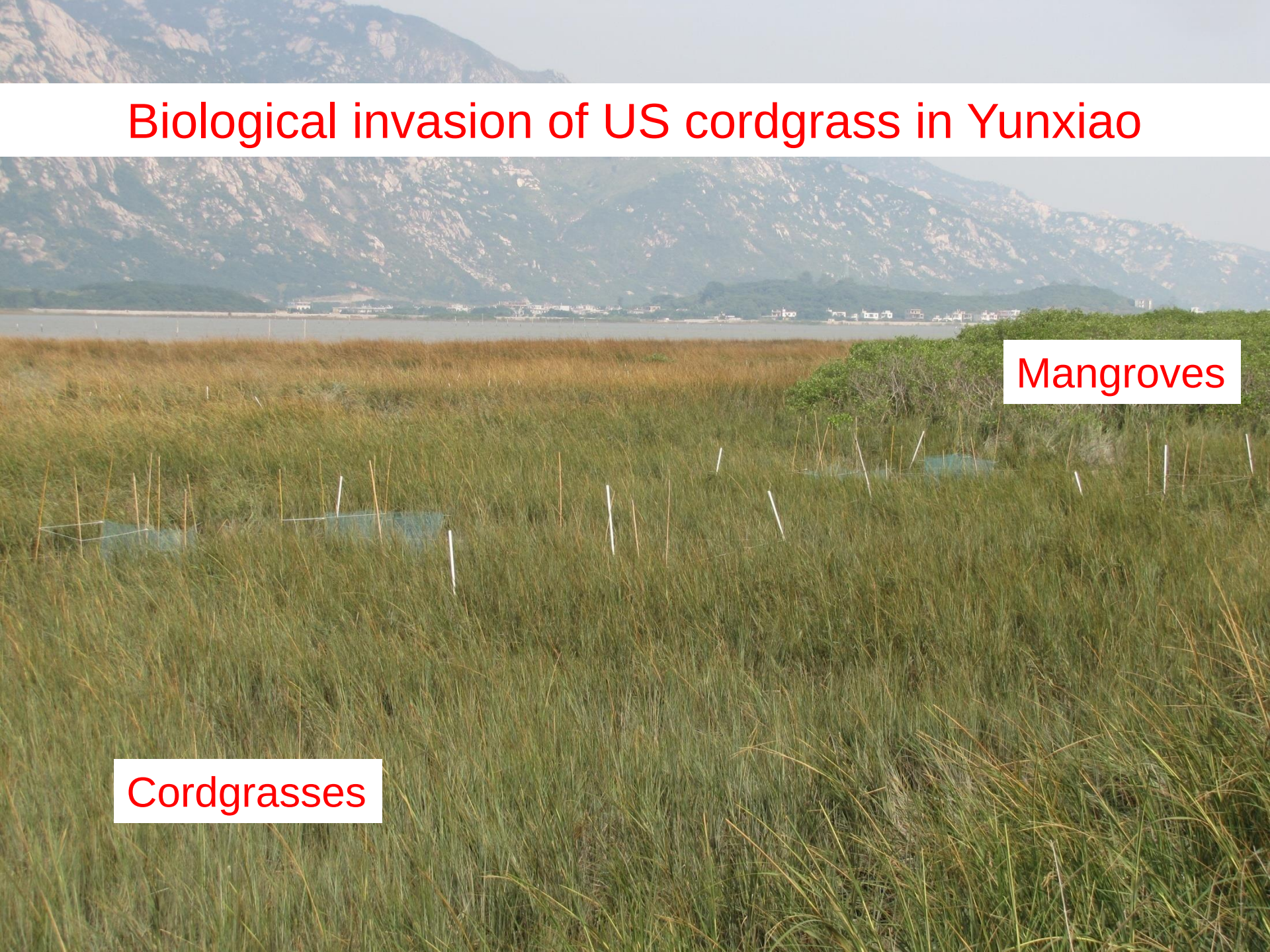
外来植物影响下红树林生态系统服务功能的维持机制

主持人：林光辉

Invasion of US Cordgrass to Chinese mangroves

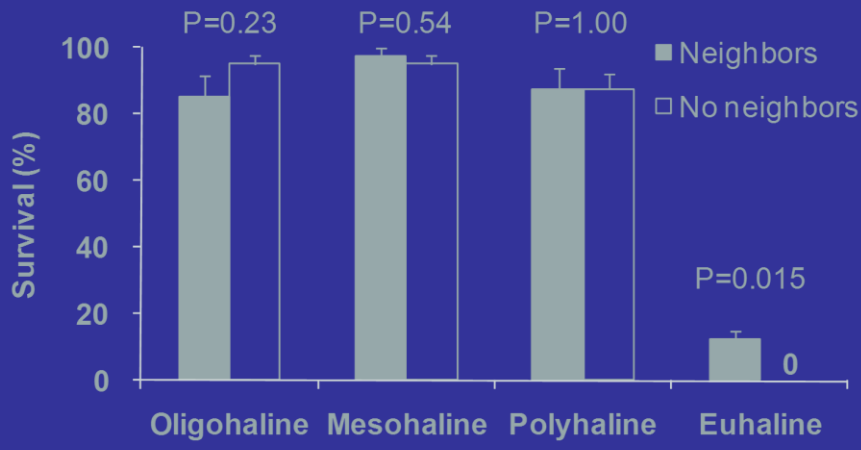
Cordgrass *(Spartina alterniflora)*

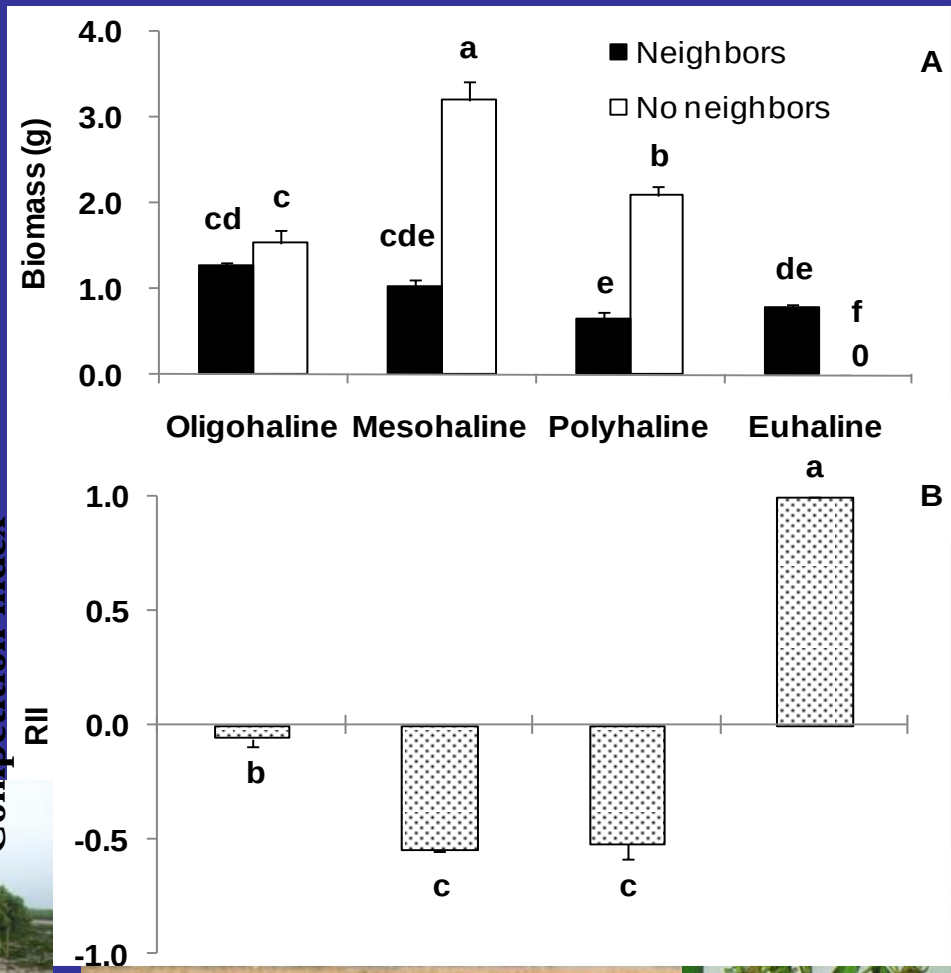
Biological invasion of US cordgrass in Yunxiao



Mangroves and cordgrass along a salinity gradient

Human disturbances facilitate invasion of cordgrass!





Ecology 2012

Zhang, Yihui, Guanmin Huang, Wenqing Wang, Luzhen Chen, and Guanghui Lin. *In press.* Interactions between mangroves and exotic Spartina in an anthropogenically-disturbed estuary in southern China. Ecology. [doi:10.1890/11-1302.1]

Interactions between mangroves and exotic Spartina in an anthropogenically-disturbed estuary in southern China

Yihui Zhang[1,*], Guanmin Huang[2], Wenqing Wang[3], Luzhen Chen[4], and Guanghui Lin[5]

[1]Key Laboratory of the Ministry of Education for Coastal and Wetland Ecosystems, Xiamen University, School of Life Sciences

Top journals in our fields

Top 19 journals in Meteorology And Atmospheric Science

Rank	Abbreviated Journal Title (linked to journal information)	ISSN	Total Cites	Impact Factor
1	B AM METEOROL SOC	0003-0007	10674	6.026
2	ATMOS CHEM PHYS	1680-7316	18402	5.520
3	INT J GREENH GAS CON	1750-5836	2023	5.111
4	GLOBAL BIOGEOCHEM CY	0886-6236	9172	4.785
5	CLIM DYNAM	0930-7575	7147	4.602
6	TELLUS B	0280-6509	3458	4.382
7	J CLIMATE	0894-8755	25403	4.097
8	ENVIRON RES LETT	1748-9326	1417	3.631
9	CLIM PAST	1814-9324	879	3.509
10	ATMOS ENVIRON	1352-2310	32572	3.465
11	AGR FOREST METEOROL	0168-1923	8615	3.389
12	CLIMATIC CHANGE	0165-0009	8798	3.385
13	ATMOS MEAS TECH	1867-1381	766	3.335
14	J HYDROMETEOROL	1525-755X	3597	3.052
15	WIRES CLIM CHANGE	1757-7780	239	2.913
16	Q J ROY METEOR SOC	0035-9009	9607	2.907
17	INT J CLIMATOL	0899-8418	7869	2.906
18	MON WEATHER REV	0027-0644	16821	2.688
19	AEROSOL SCI TECH	0278-6826	4665	2.667

Top 19 journals in Ecology

Rank	Abbreviated Journal Title (linked to journal information)	ISSN	Total Cites	Impact Factor
1	ECOL LETT	1461-023X	14561	17.557
2	TRENDS ECOL EVOL	0169-5347	22734	15.748
3	ANNU REV ECOL EVOL S	1543-592X	14049	14.373
4	FRONT ECOL ENVIRON	1540-9295	3745	9.113
5	ECOL MONOGR	0012-9615	8300	7.433
6	ISME J	1751-7362	3899	7.375
7	GLOBAL CHANGE BIOL	1354-1013	16313	6.862
8	MOL ECOL	0962-1083	26842	5.522
9	P ROY SOC B-BIOL SCI	0962-8452	34839	5.415
10	ADV ECOL RES	0065-2504	1618	5.333
10	WILDLIFE MONOGR	0084-0173	665	5.333
12	EVOLUTION	0014-3820	29505	5.146
13	GLOBAL ECOL BIOGEOGR	1466-822X	4418	5.145
14	ECOL APPL	1051-0761	14988	5.102
15	METHODS ECOL EVOL	2041-210X	278	5.093
16	J APPL ECOL	0021-8901	11471	5.045
17	J ECOL	0022-0477	12765	5.044
18	J ANIM ECOL	0021-8790	11942	4.937
19	ECOLOGY	0012-9658	47545	4.849

Other top journals

Agricultural and Forestry Meteorology:

#1 in Agricultural and Forestry Scineces

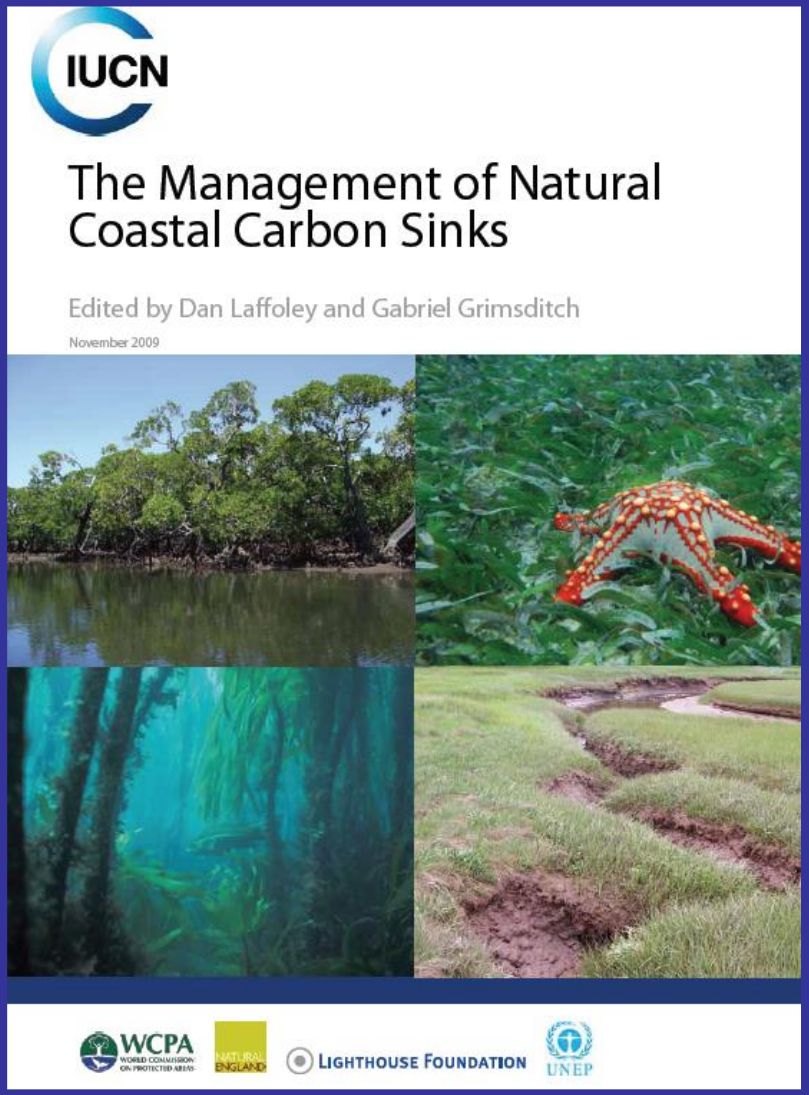
Soil Biology & Biochemistry:

#1 in soil sciences

Plos One:

Most popular in open access journals

Blue carbon sink potentials in global mangroves



nature geoscience

LETTERS

PUBLISHED ONLINE: 3 APRIL 2011 | DOI: 10.1038/NGEO1123

Mangroves among the most carbon-rich forests in the tropics

Daniel C. Donato[1]*, J. Boone Kauffman[2], Daniel Murdiyarso[3], Sofyan Kurnianto[3], Melanie Stidham[4] and Markku Kanninen[5]

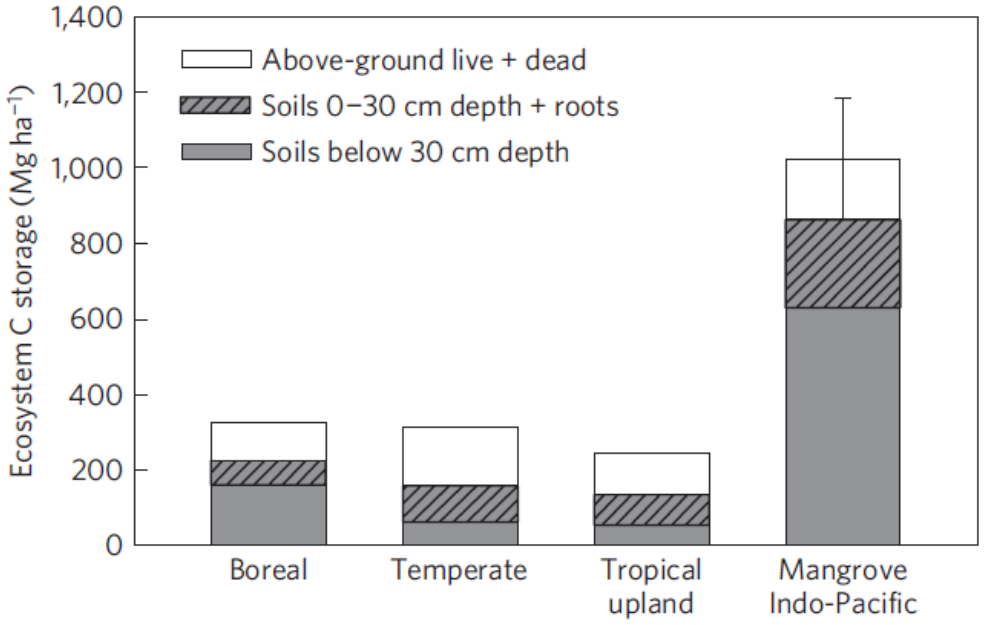
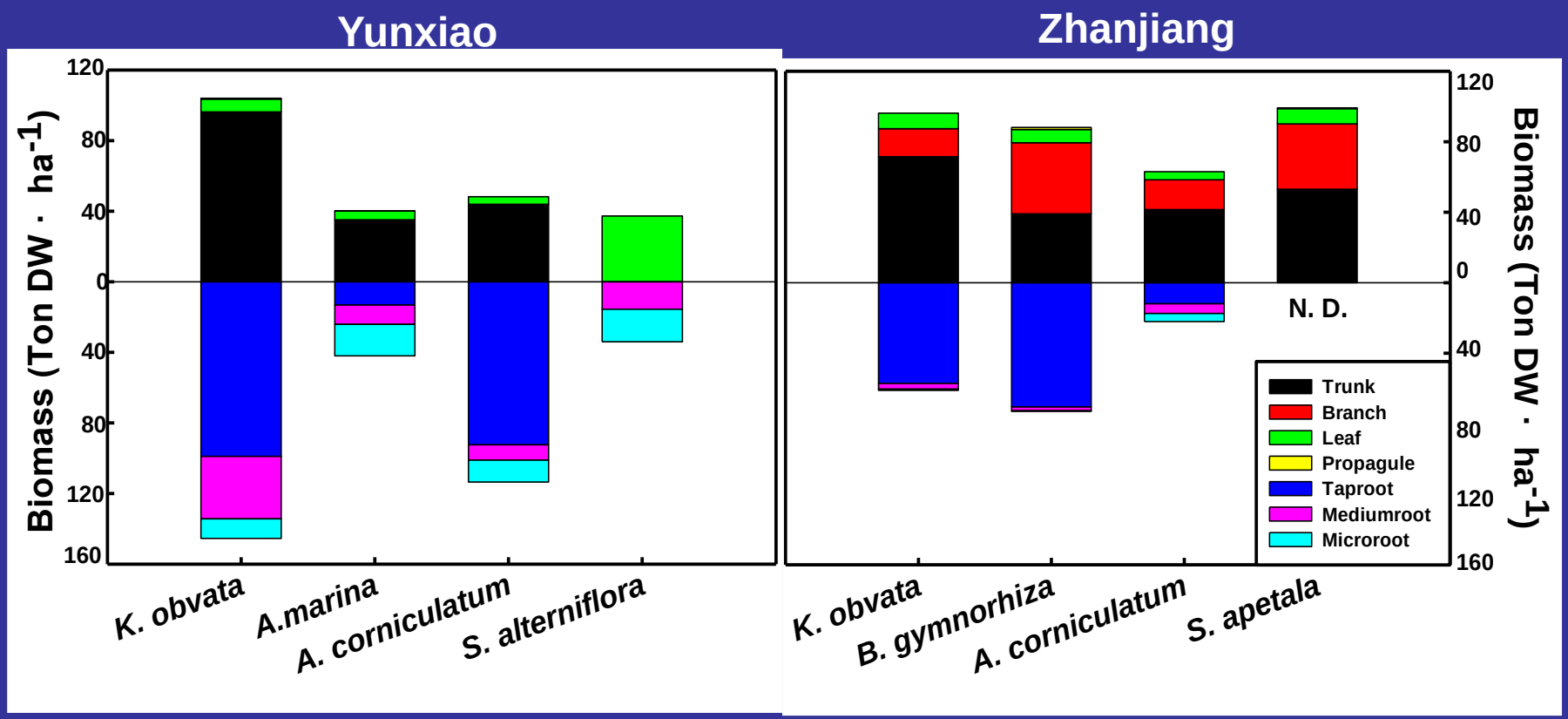


Figure 2 | Comparison of mangrove C storage (mean ±95% confidence interval) with that of major global forest domains. Mean C storage by

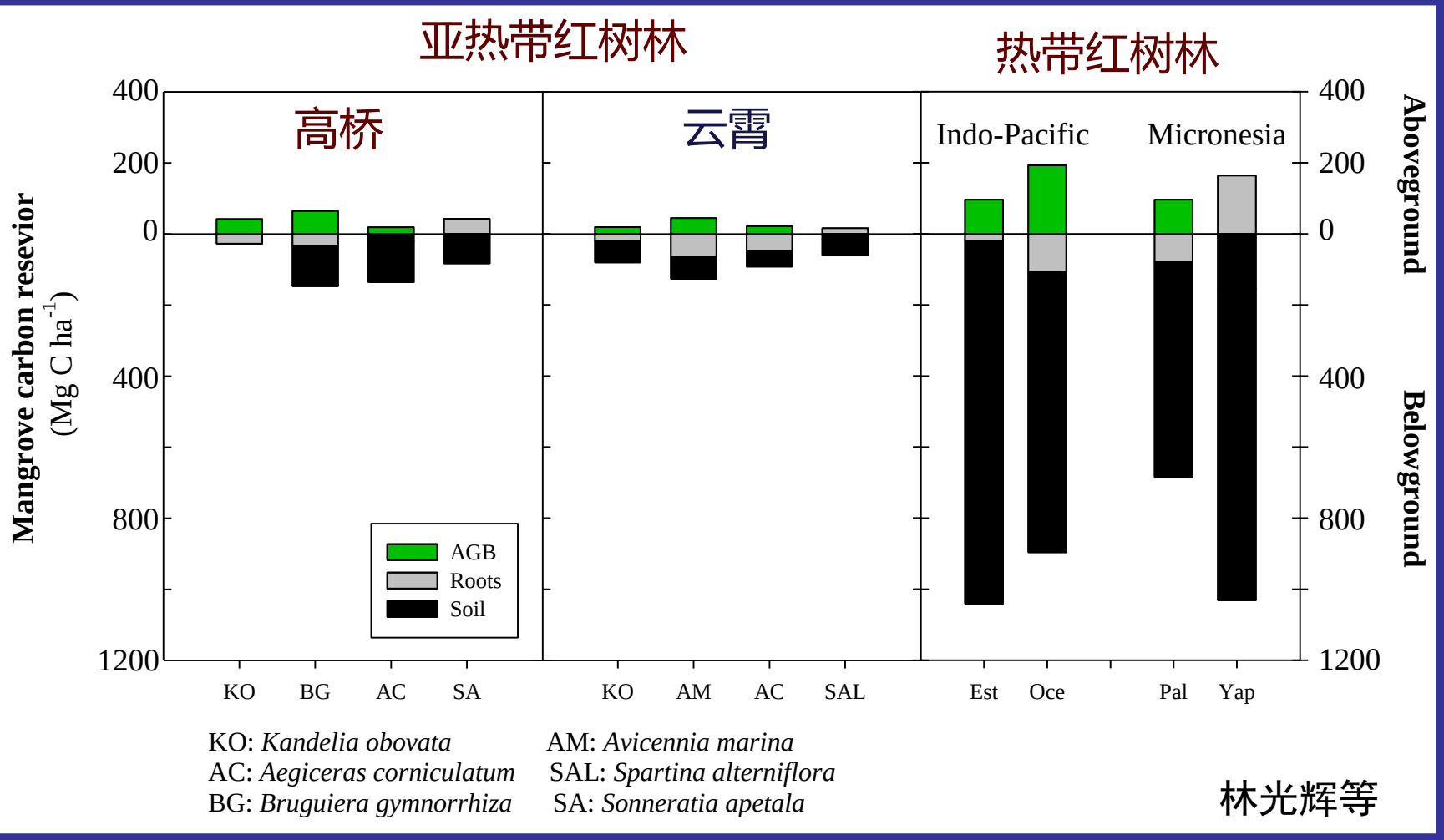
Biomass (Mg DW ha^{-1}) of mangrove forests



Up to 120 Mg C/ha stored in biomass, but varied among species!

Lu et al., Plos One (in review)

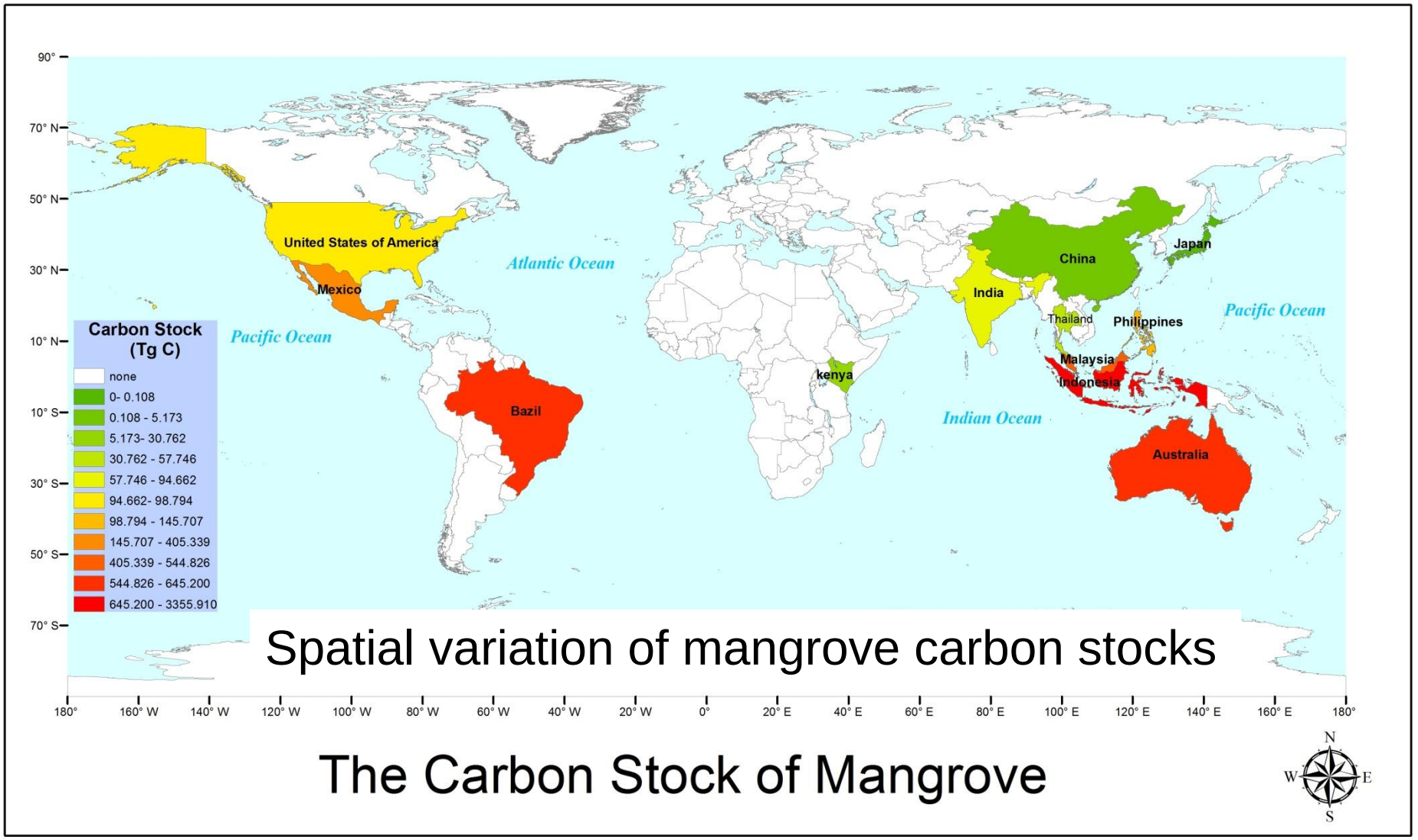
红树林碳储量比较



KO: *Kandelia obovata*
AC: *Aegiceras corniculatum*
BG: *Bruguiera gymnorrhiza*
AM: *Avicennia marina*
SAL: *Spartina alterniflora*
SA: *Sonneratia apetala*

林光辉等

Most countries with significant mangrove C are developing countries!

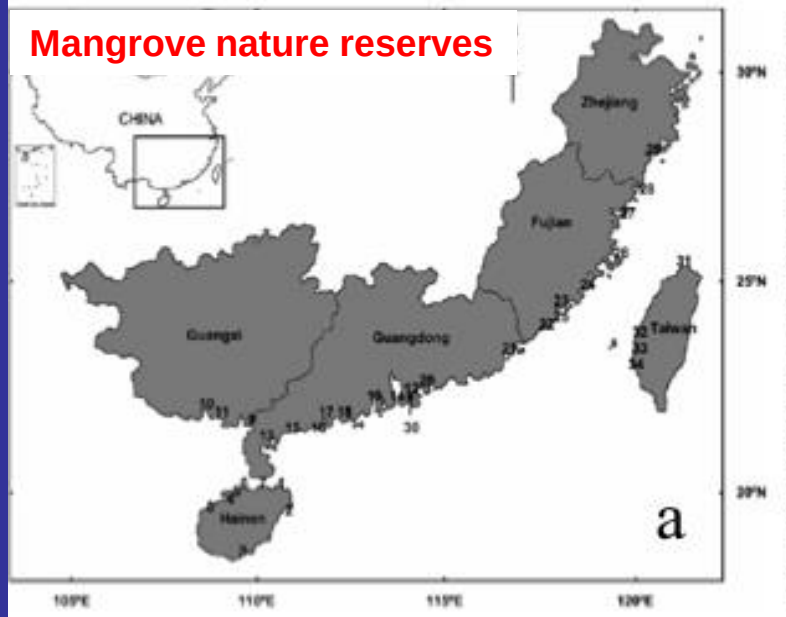


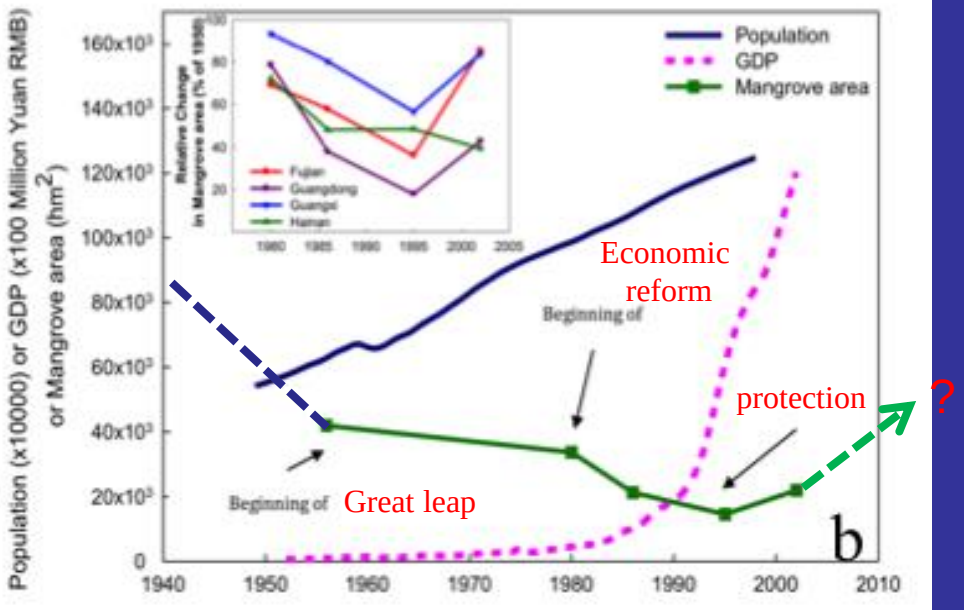
Spatial variation of mangrove carbon stocks

The Carbon Stock of Mangrove

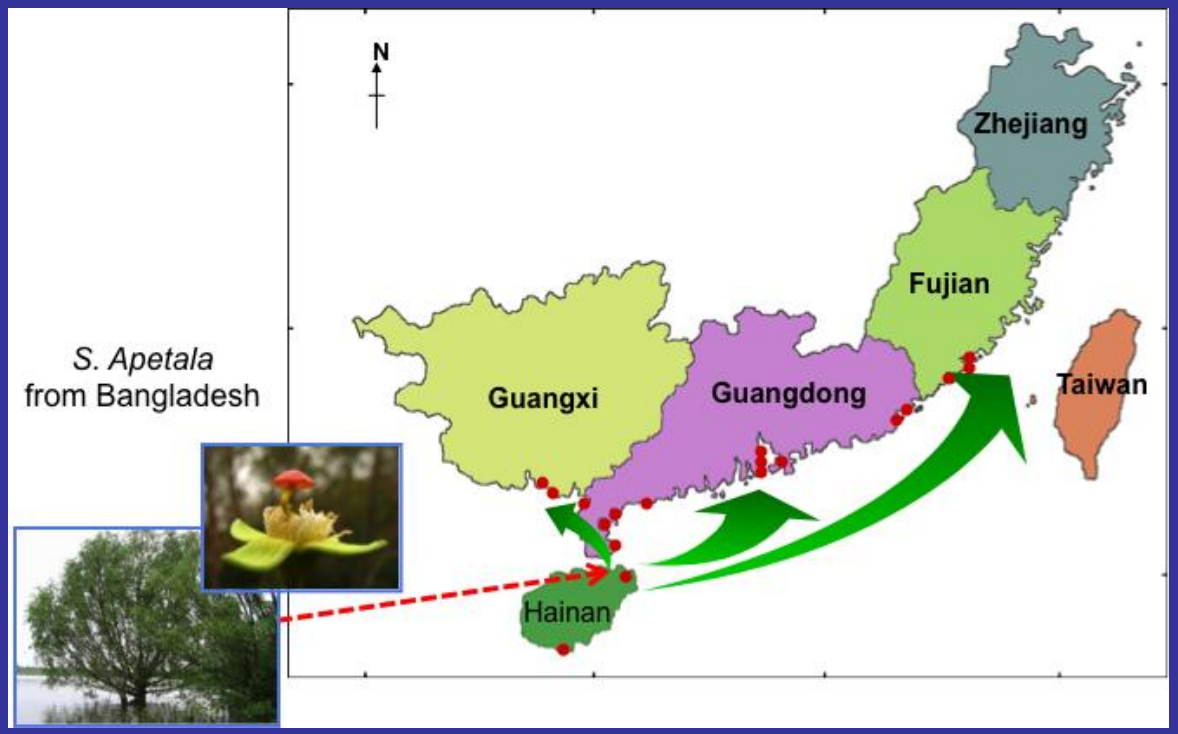
Lin et al., manuscript in preparation

Changes in Chinese mangroves during last 6 decades

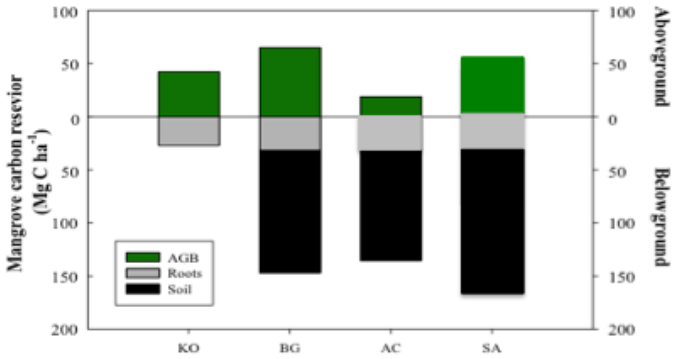


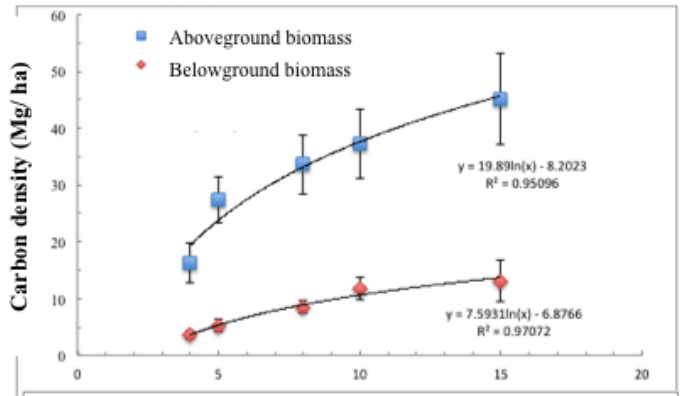


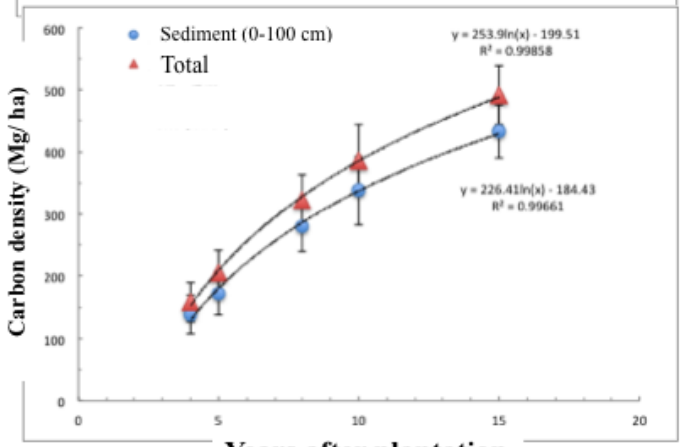
Mangrove plantation with fast-growing exotic species can increase blue carbon sink in mangrove wetlands!



Almost 10% of total mangrove area in China



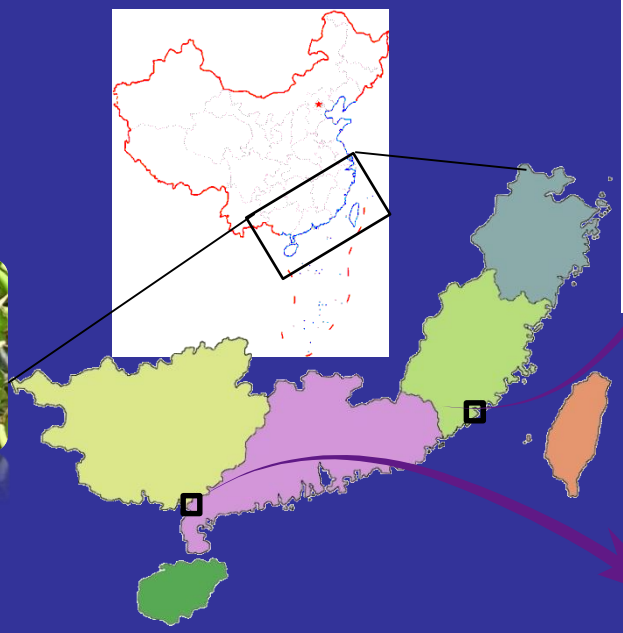


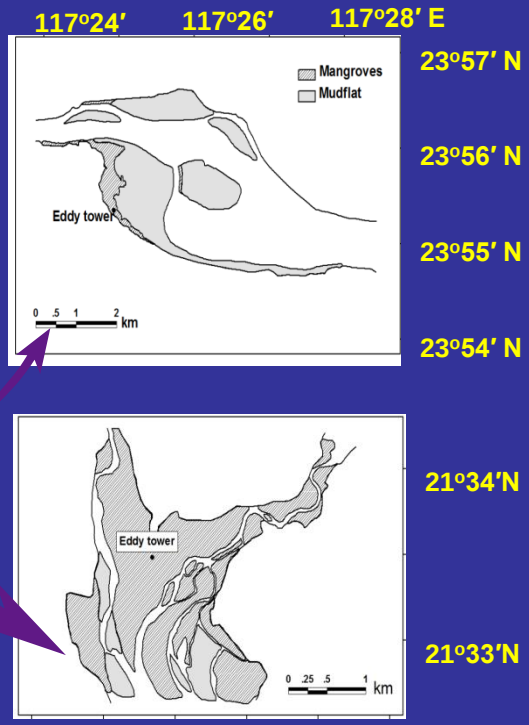


Lin et al., manuscript in preparation

研究地点

（高桥站）



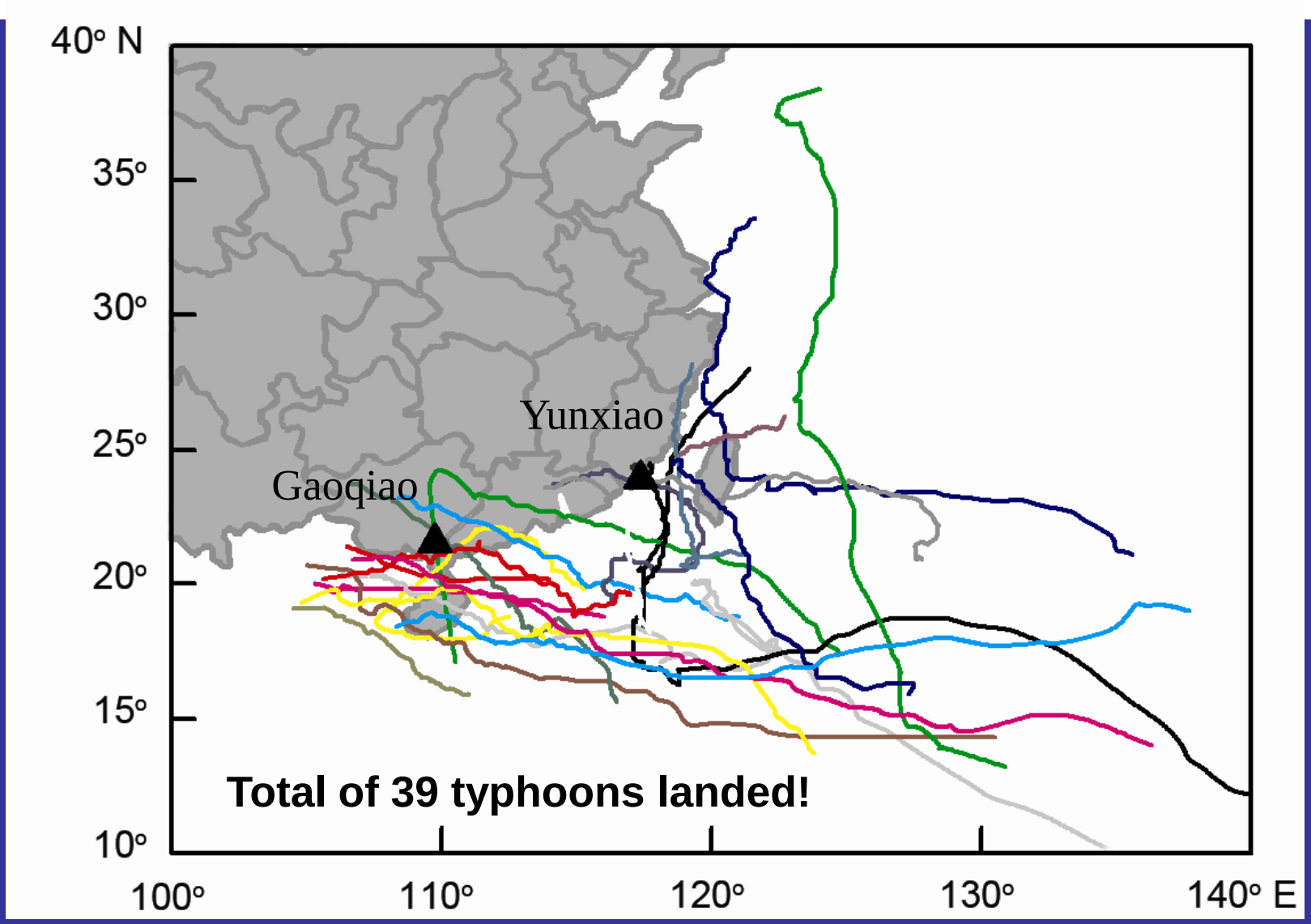


（云霄站）

高桥红树林（广东湛江）
云霄红树林（福建漳州）

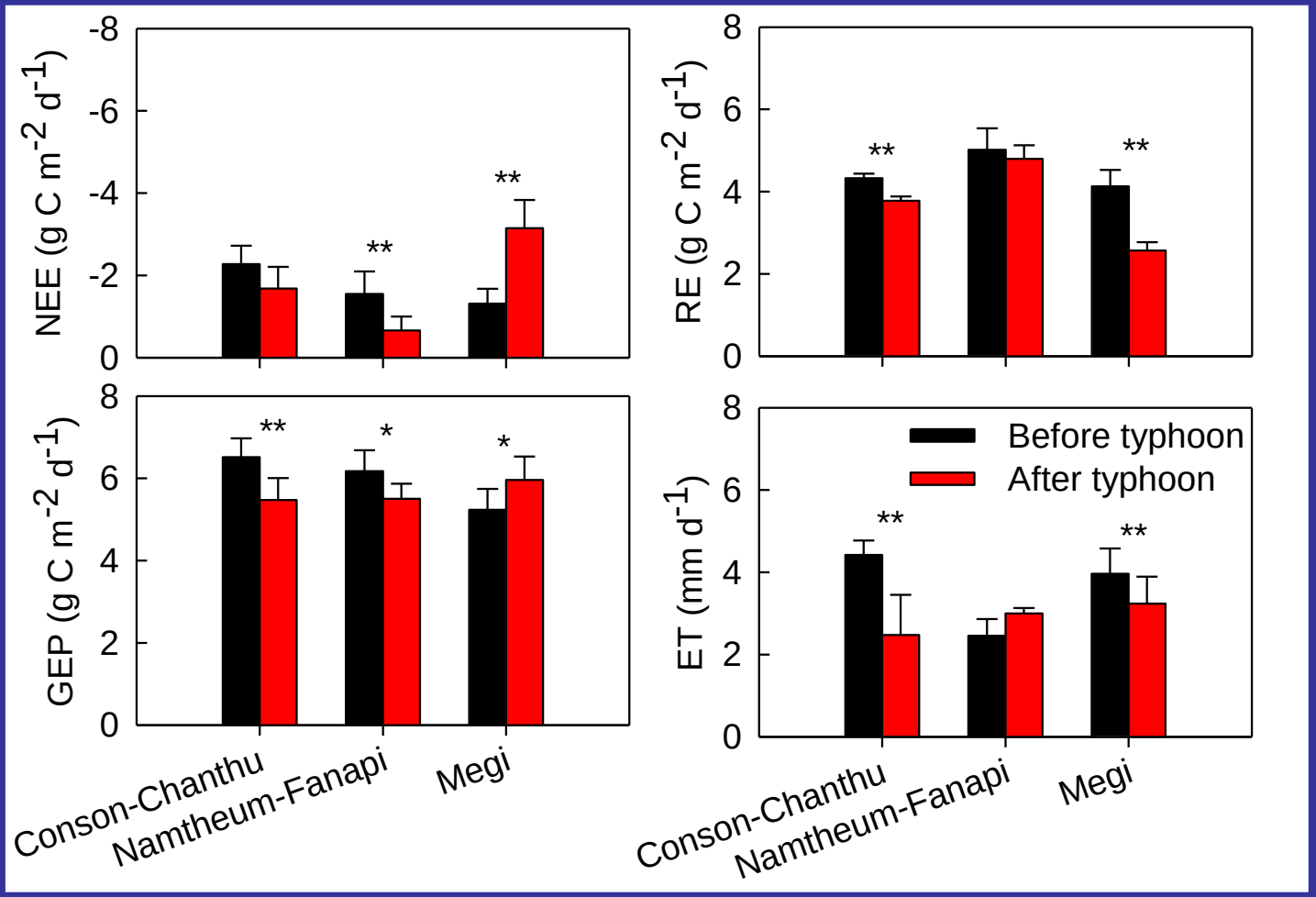
Gaoqiao Site, Guangdong

Typhoons in SE China during 2009-2011



Chen et al. submitted to ***Biogeoscience***

In most cases, typhoons reduce C sequestration!



Chen et al. submitted to ***Biogeoscience***

More frequent insect outbreaks!

救救福田红树林！ 虫害肆虐 生态系统恶化

2012-06-19 08:47 来源：晶报

专家说，上世纪80年代，台湾嘉义县红树林自1987年开始开发机械化盐滩，生态环境受到破坏，1993年发生了大面积的红树林虫害，引起相当数量的白骨壤死亡。据中山大学生物防治国家重点实验室、昆虫学研究所专家调研，福田红树林害虫发生的原因有三个：

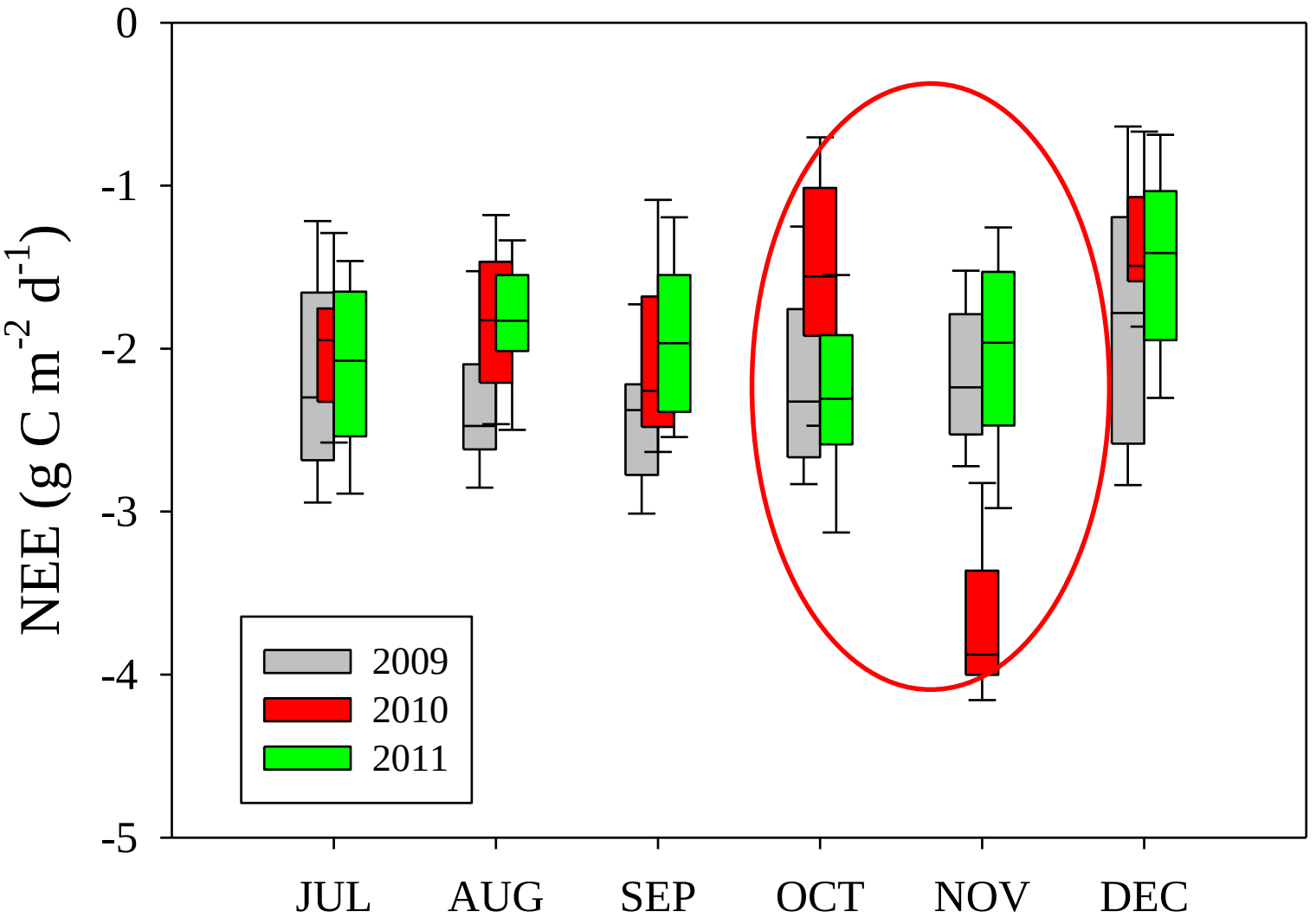
Shenzhen, 2012

Yunxiao, 2011

Zhanjiang, 2010

Lu, et al. Manuscript in prep

Fast recovery in NEE following insect outbreak!



Lu, et al. Manuscript in prep

Model Earth for Experimental and Simulation Research

Model Earth?

Disturbances

Future climate

Model predictions

Response mechanisms

Impact assessments

Model verification and improvement

Take home messages

✓Ecosystems of our earth provide vital services to us, which cannot be easily reproduced if loss;

✓We face great challenges from global change, which alter significantly ecosystem services we need every day;

✓More research are needed to understand the mechanisms underlying the ecosystem services, which will be critical to predict the future state of our earth under climate change.