

# 碳汇交易:为在中国实现 可持续发展的森林管理



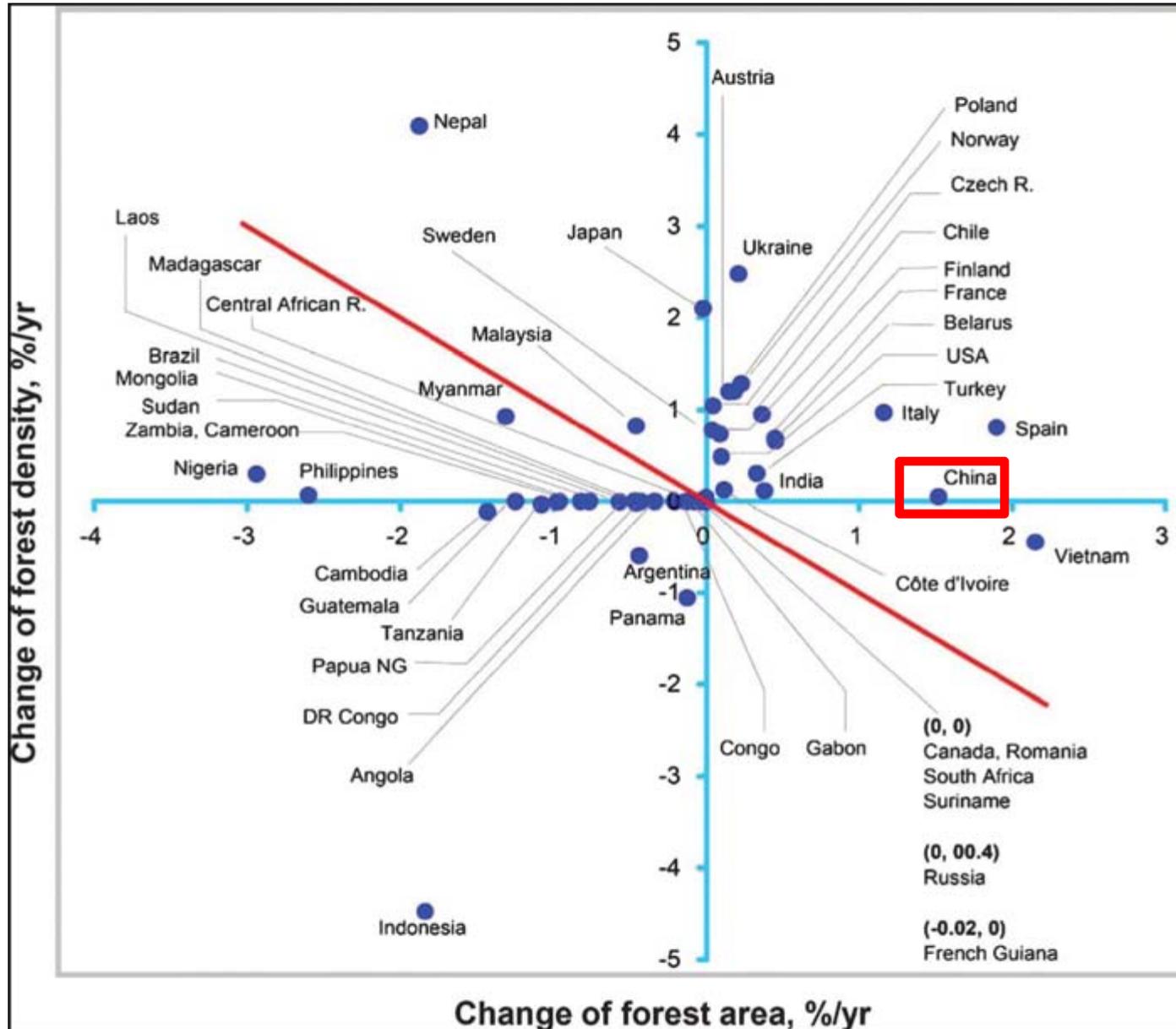
The International Workshop on the Development of  
Forestry Carbon Sequestration and Wood-based Biomass Energy  
December 15-18, 2008, Beijing Friendship Hotel



Timm Tennigkeit 博士  
中国科学院和世界混农林业中心



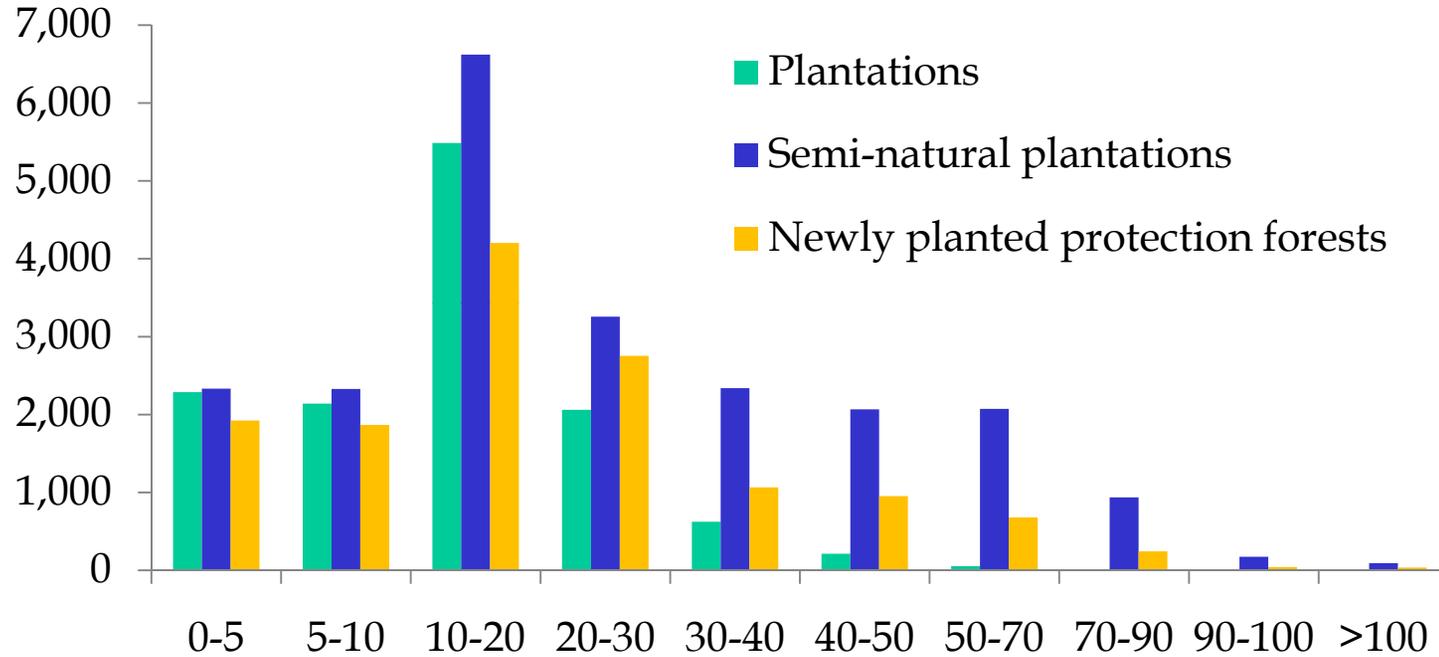
# 森林面积和密度1990-2005 (FAO资料)



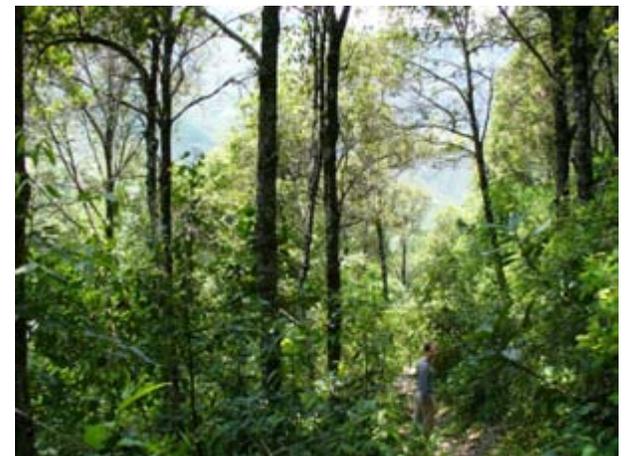
Source: Kauppi et al., PNAS 2006

# 中国新增树木的树龄分布

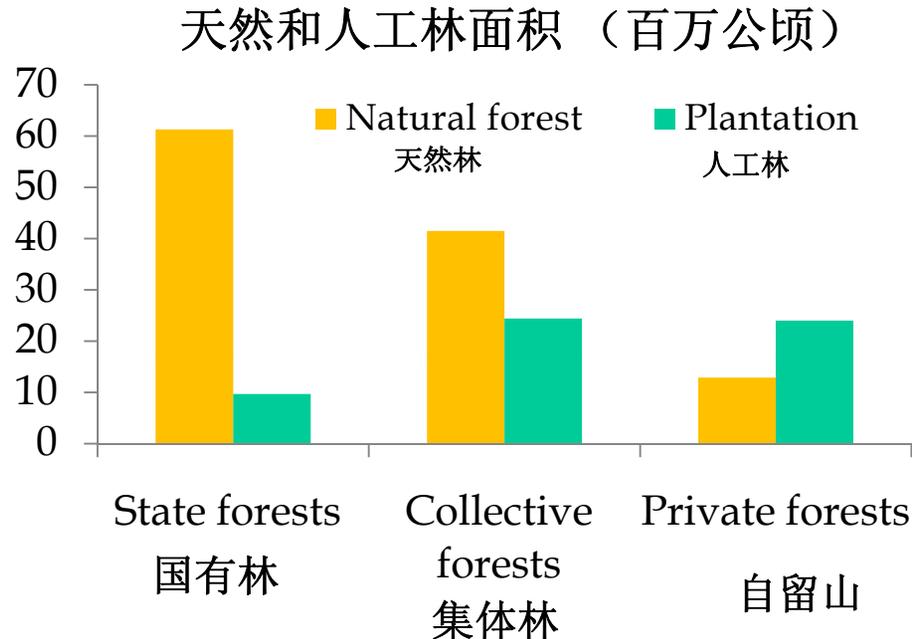
Area in 1,000 ha, 合计5300万公顷



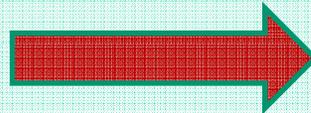
胸径等级



# 中国林业潜力和碳汇贸易



84立方米/公顷



200立方米/公顷

林地面积：1.72亿公顷减排潜力 = +35 Gt 的CO<sub>2</sub>

中国温室气体年排放量 = 5 Gt 的CO<sub>2</sub>

# 能有助于吸收更多的二氧化碳和产生碳额度的森林管理类型和森林产品

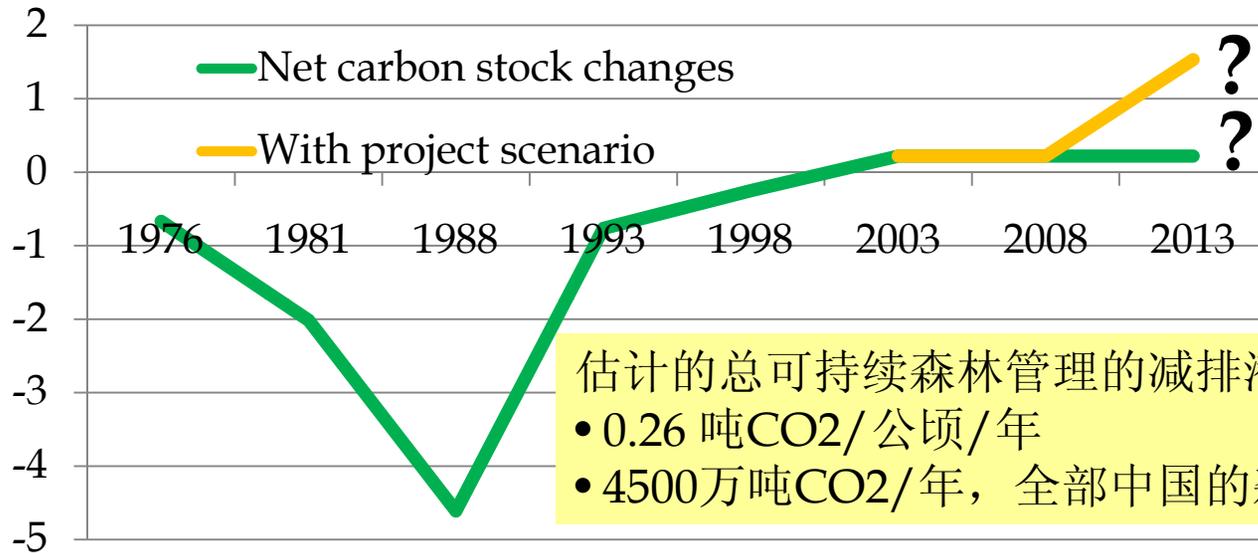


# 中国可持续森林管理减排活动的潜力

基线	<p>大部分森林未进行管理，且平均蓄积量较低：</p> <ul style="list-style-type: none"><li>• 全部森林: 85 立方米/公顷 (140 tCO<sub>2</sub>/ha)</li><li>• 人工林: 47立方米/公顷 (80 tCO<sub>2</sub>/ha)</li></ul>
采用可持续森林管理可以增加碳储量	<ul style="list-style-type: none"><li>• 增加树木直径和延长轮伐周期</li><li>• 终止终止目前砍伐不成熟树木的做法，同时把重点放在低质林的未来增量效果上</li><li>• 通过从单一林种植到近自然林管理的转变，促进森林在纵向和横向结构上的转变</li><li>• 通过支持自然更新和选择适合的树种，提高现有活力木的树种匹配 (预计成本：50—100元/吨二氧化碳)</li></ul>
额外性的理由	<ul style="list-style-type: none"><li>• 体制障碍 - 通过国有林场之外的管理变革</li><li>• 技术壁垒 - 管理计划、造林管理</li><li>• 资金屏障 - 过度期的额外费用和收益减少</li></ul>
渗漏	<p>在过渡时期减少采伐量将有可能增加从俄罗斯等国进口不可持续的资源</p>

# 可持续森林管理在中国减排的潜力

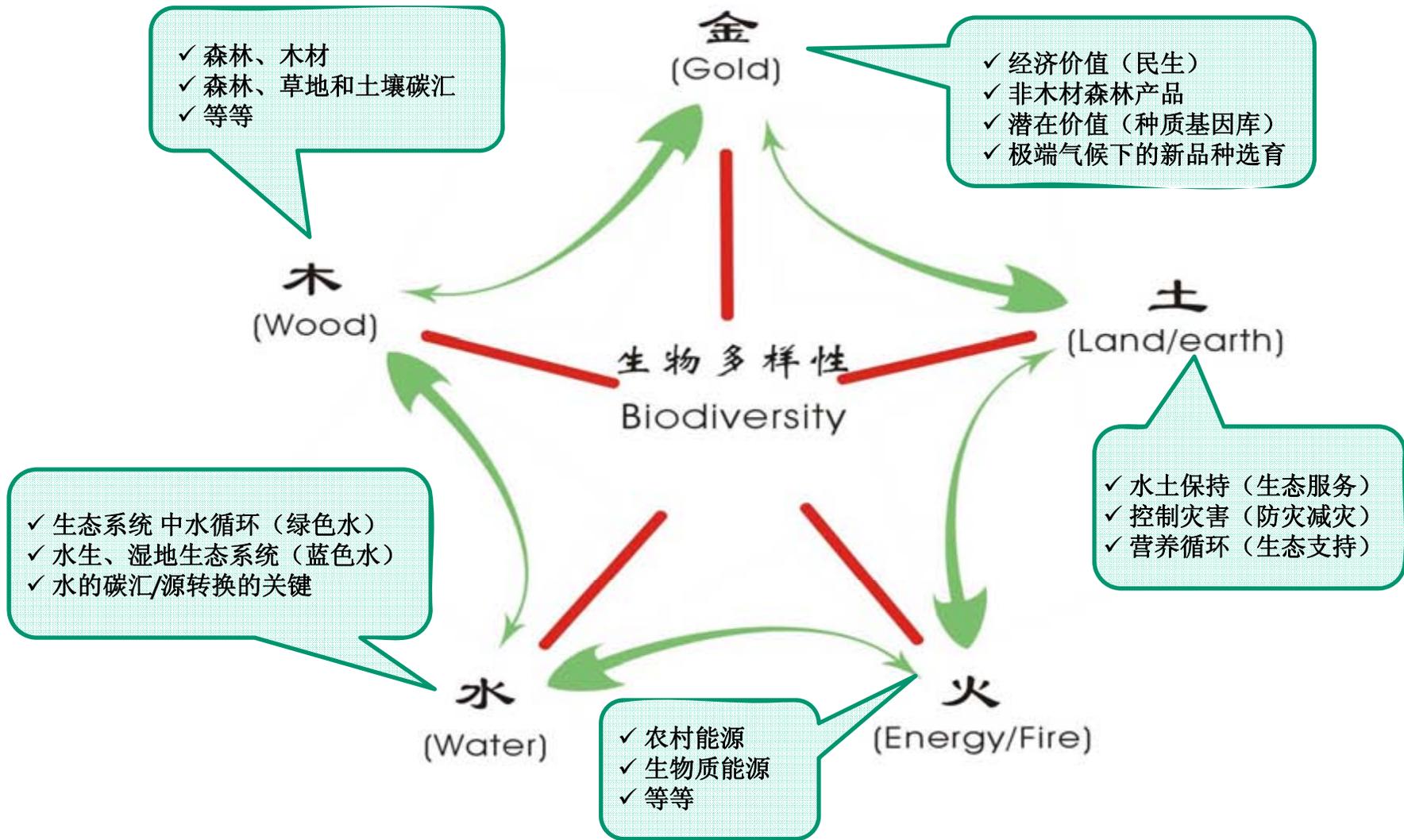
净碳储量变化：基线和项目情况 吨CO<sub>2</sub>/公顷/年。



## 备注:

- 基线数据：国家林业局，第六次森林资源普查
- 估计无记录的木材利用率占有利用记录的0.3-0.9 (最高的无记录使用是在1983年森林改革后)
- 随着项目的额外增长: 1.4 立方米/公顷/年，代表50 %的平均增长 (Source: Zhang & Xu, 2003)
- 中国是世界上最大的温室气体排放国家5.6 GtCO<sub>2</sub>/年或 5.1 tCO<sub>2</sub>/人/年；温室气体排在2007年的增加值是5亿吨二氧化碳。
- 林业减排办法可以减少约10 %的年均增长量

# 为什么生物多样性？



# 林业碳汇项目的必备条件

- 从执行能力、经济规模和公平与性别等方面通盘考虑，**建立相关的机制。**
- 公认的市场**标准和核准的方法**，详细的基线与碳监测方法。
- **项目设计文件**详细说明
  - 基线和项目方案；
  - 明确的额外性理由，以证明该项目只因是碳汇项目的组成部分才得以执行；
  - 泄漏的评估，以避免造成该项目在项目区外新的额外碳排放；
  - 永久性 or 可逆性评估，以避免在项目期间或项目结束之后固碳量的排放；
  - 监测计划的详细设计和监测的间隔时间。
- **独立的第三方根据标准要求的认证**

## 比较不同的全球碳汇市场的林业项目

特征	京都监管市场	其它监管和预监管市场	自愿碳市场
监管框架	联合国气候变化框架公约、清洁发展机制	例如：新南威尔士州温室气体减排计划（新南威尔士州GGAS），美国前遵守市场	自愿碳标准，CCX，CCBA
交易额 2007	2900 Mt/CO <sub>2</sub> e	25 Mt/CO <sub>2</sub> e (NSW GGAS)	65 Mt/CO <sub>2</sub> e
符合条件的森林活动	造林	取决于国家的政策，包括造林, REDD和可持续森林管理等	造林, REDD, 可持续森林管理
林业项目	< 1%		18 %
与中国林业有关的项目	造林项目、可持续森林管理也许在2012年之后	<b>具有很大的潜力，如果国家限额交易系统能够发展，且林业具有资格</b>	AR/REDD /SFM 优质项目

# 演变中的林业碳汇里程碑

**中国应对气候变化国家方案(2007. 6), 主要目标:**

- 采用科学的办法，减缓和适应气候变化
- 到2010年减少单位国内生产总值能源消费量的20%
- 到2010年森林覆盖率在2005年的水平上提高20%，森林碳汇增加5000万吨。

**亚太经合组织会议（APEC）宣言(2007. 9):**

中国提出的...由中国主办设立亚太地区亚太森林恢复与可持续管理网络，为改善和促进亚太地区的可持续森林管理和森林恢复，以缓解气候变化。

**巴厘宣言(2007. 12):**

加强减缓气候变化的行动，包括...可持续的森林管理和提高发展中国家的森林碳储存。

**第四次中国森林对话论坛“森林与气候变化”(2008. 5)**

- 由 SFA, CAF, APF-Net, FAO & GTZ组织

**森林可持续管理国际研讨会(2008. 9), 由国家林业局和德国复兴信贷银行组织**

**国务院解决气候变化问题的政策和行动白皮书(2008. 10)**

**中国碳平衡交易框架研究报告(2008.11)**

# 中国林业碳汇市场

国际和国内林业碳汇项目:

*中国清洁发展机制项目 (2006, 2008):*

- 广西流域造林: 2,000公顷
- 广西西北部造林: 8,000公顷

*CCBA AR 项目在中国 (2007, 2008):*

- 景观恢复, 云南腾冲: 500公顷
- 四川北部造林项目: 2,600公顷
- 多用途森林恢复, 云南: 1,300公顷

*中国绿色碳基金:*

- 在2007年筹集2.2亿人民币, 造林7万公顷

不断变化的碳交易平台:

中国绿色碳基金  
北京环境交易所  
天津产权交易所



# 结 论

- 中国的森林投资重点正在逐步从造林转向可持续森林管理。
- 通过森林恢复与可持续森林管理，将有助于提高森林的碳储存，同时增加中国6000万户家庭的收入。
- 2012年后国际气候变化框架和国内限额贸易体系的构建需要扩大碳交易在土地利用领域的规模。这个框架也提供了一些环境和社会的保障制度。
- 对于林业部门来说重要的是要准备一个国家的排放贸易体系。因此，部门的温室气体清单必须具备，同时应考虑开发部门或系统的方法，以开展林业碳汇的试点项目。

# 世界混农林业中心有关碳汇和生物能源的出版物: [www.chinaagroforestry.org/](http://www.chinaagroforestry.org/)



**Re-Impact China**  
 Re-Impact Project Briefing No. 10

**Energy, Carbon, and Bioenergy in China**

China is the world's second largest energy consumer, consuming 1,983 million tons of oil equivalent (toe), or 17% of global primary energy consumption, in 2007. Since 1990 China has accounted for 40 percent of the growth in global energy consumption. However, per capita energy consumption in China (1.2 toe, 2005) remains low vs 5–6 toe OECD countries (4.7 toe).

By most estimates, China is now emitting more greenhouse gases than any other country with estimated energy-related emissions of 5,101 MCO<sub>2</sub>e in 2005. Alternatively, the country's per capita GHG emissions (319 tCO<sub>2</sub>e/person, 2005) were roughly one-third of OECD per capita emissions of 11 tCO<sub>2</sub>e/person. Reducing GHG emissions in China will be a major global challenge over the next four decades.

As a low carbon or even carbon neutral resource, bioenergy can play a role in reducing carbon emissions growth in China, particularly in rural areas. Within the context of China's massive demographic and land use transition, however, both the potential for bioenergy and the policies that would unlock this potential in an economically, environmentally, and socially sustainable manner remain unclear.

**Bioenergy in China**

China is currently the world's largest consumer of biomass-based energy, accounting for an estimated 20% of global bioenergy use in 2005. Most of this consumption occurs in rural areas, where "traditional" biomass use is the dominant energy source for cooking and heating. As China continues to transition from a rural to a more urban society, policy interventions will be needed to ensure that bioenergy plays a role in fulfilling socioeconomic and environmental goals.

**National Bioenergy Policy**

China's Renewable Energy Law, passed in 2005, aimed to strengthen the country's position as a global leader in renewable energy. Renewable energy currently accounts for only a small share of China's total primary energy use, not yet large enough to cover its annual energy demand growth. The Chinese government has ambitious plans to increase the share of renewable energy to 16% by 2020. Bioenergy plays an important role in these plans, with initiatives to increase the production of biogas, biomass power, centralized biomass heating, bioethanol, and biodiesel. Promoting advanced stoves will be an important strategy for increasing the efficiency of bioenergy use.

**National Bioenergy Policy**

Energy security  
 Rural economic development  
 Climate change policy  
 Migration and land use transition



**China's Bioenergy Future Through the Lens of Yunnan Province**

*Heekick Kohel, Yun-Mei Xu, Feng-Tsun Tseng, and Andrew Wilton and David Richard Miller*

**An Assessment of the Potential for Carbon Finance in Rangelands**

*Tina Donaghy and Andrew Wilton*

Working Paper

Working Paper

Working Paper

World Agroforestry Centre  
 Southeast Asia



**Sustainable Forest Management and Carbon Forestry in China**

**Incentives for Improved Rangeland Management in China: The potential of carbon finance**

**Incentives for Sustainable Agricultural Land Management: The potential of carbon finance**

**Challenges in China's agricultural sector**

Per capita arable land holdings in China are only 40% of the world's average. Agricultural land covers 113 million ha in China, but total arable land area is declining. The pressure on food production is increasing as consumption of meat products increases, thus increasing demand for both land and water. Chinese agriculture's use of water and fertilizer per unit output are higher than world averages, and increasingly relies on rainwater because groundwater levels are decreasing. With climate change predicted to stress water supplies further, it is crucial to find sustainable ways to increase productivity on the low and medium productivity lands which account for 70% of China's total. Sustainable agriculture has been given a prominent role in China's national sustainable development strategy. Practices such as no-tillage cultivation and crop residue management can increase soil organic matter, reduce tillage and also sequester soil carbon, and can therefore have important roles in both climate change mitigation and adaptation.

**The potential role of carbon markets**

The IPCC estimates the annual agricultural mitigation potential in China to be between 436–829 MCO<sub>2</sub>e/yr, equivalent to 8–15% of the China's total GHG emissions. Improved soil management has the greatest potential to sequester CO<sub>2</sub>. Many sustainable agricultural practices have mitigation effects. In warm, moist climate zones, estimated annual sequestration rates are 0.82 CO<sub>2</sub>e/ha for improved rice paddy management, 0.72 CO<sub>2</sub>e/ha for degraded soil management and agroforestry, and as high as 3.46 CO<sub>2</sub>e/ha for reclamation of degraded lands. Though actual rates also depend on site-specific soil properties and climate, agricultural mitigation activities are often cost competitive and provide synergies with adaptation and sustainable development targets, but additional investments are required to spread their adoption. Carbon markets are a potential source of co-funding to make the required investments.

**The need for readiness in the agricultural sector**

Intergovernmental, and in some countries, governmental regulations already exist that put caps on CO<sub>2</sub> emissions and support the trade of emissions reductions (ERs). China's central bank has reportedly drafted a plan for a national emission cap and trade system. Considering that China's future carbon market is likely to be much larger than the current international carbon market, China's agriculture sector should prepare itself to target this carbon market segment. In order to learn from practical experience, agricultural land management carbon finance pilot projects should be developed that result in high quality carbon assets meeting international standards. At the very least, the impact of management interventions on carbon stocks should be documented in order to prove additional. A close collaboration with the National Leading Group on Climate Change and other relevant ministries is required to establish a framework for a national terrestrial carbon budget and related emission trading mechanisms.

**China Agroforestry**

World Agroforestry Centre  
 Southeast Asia  
 For more information, contact: Dr. Tina Tseng, tina@atlas.kit.edu.cn  
 CIMIS, Kunming Institute of Botany of the Chinese Academy of Sciences, Kunming, China. Tel: +86 (0)871 5222014

[www.ceg.ncl.ac.uk/reimpact](http://www.ceg.ncl.ac.uk/reimpact)