

Combating Desertification in China

—— Technology & Mitigation Strategies

LU Qi, Director & Chief Scientist

Institute of Desertification Studies, Chinese Academy of Forestry &
National Research & Development Center for Combating Desertification

CAF Campus, YuQuanShan, Beijing 100091, China

Tel/Fax: 8610-6288 8905/6282 4018

E-Mail: Luqi@caf.ac.cn/Luqi.ids@gmail.com

内蒙响沙湾 (摄影: 林然)

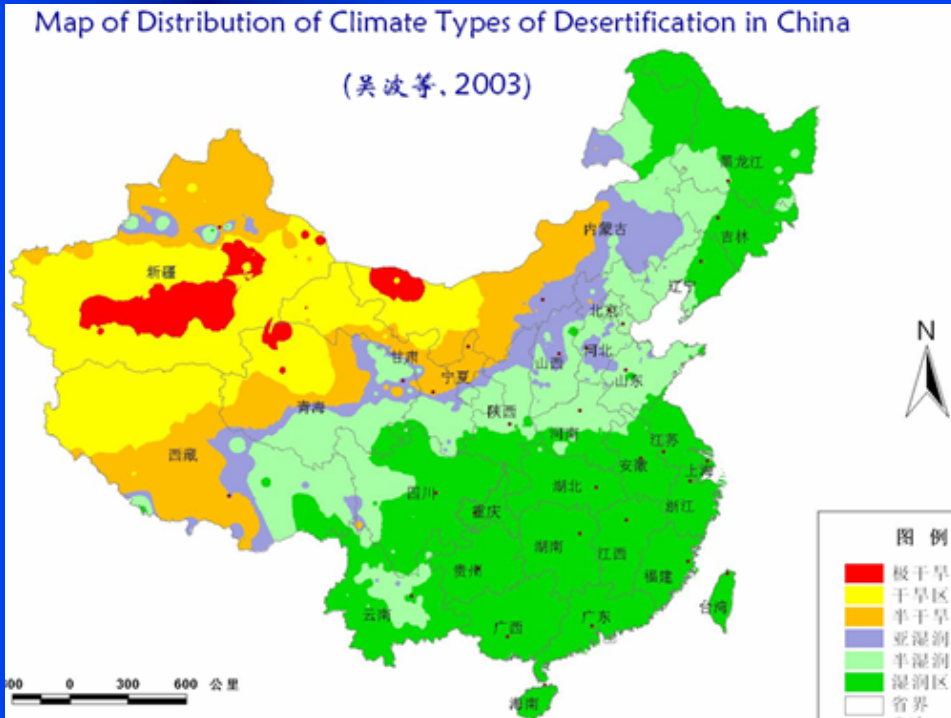
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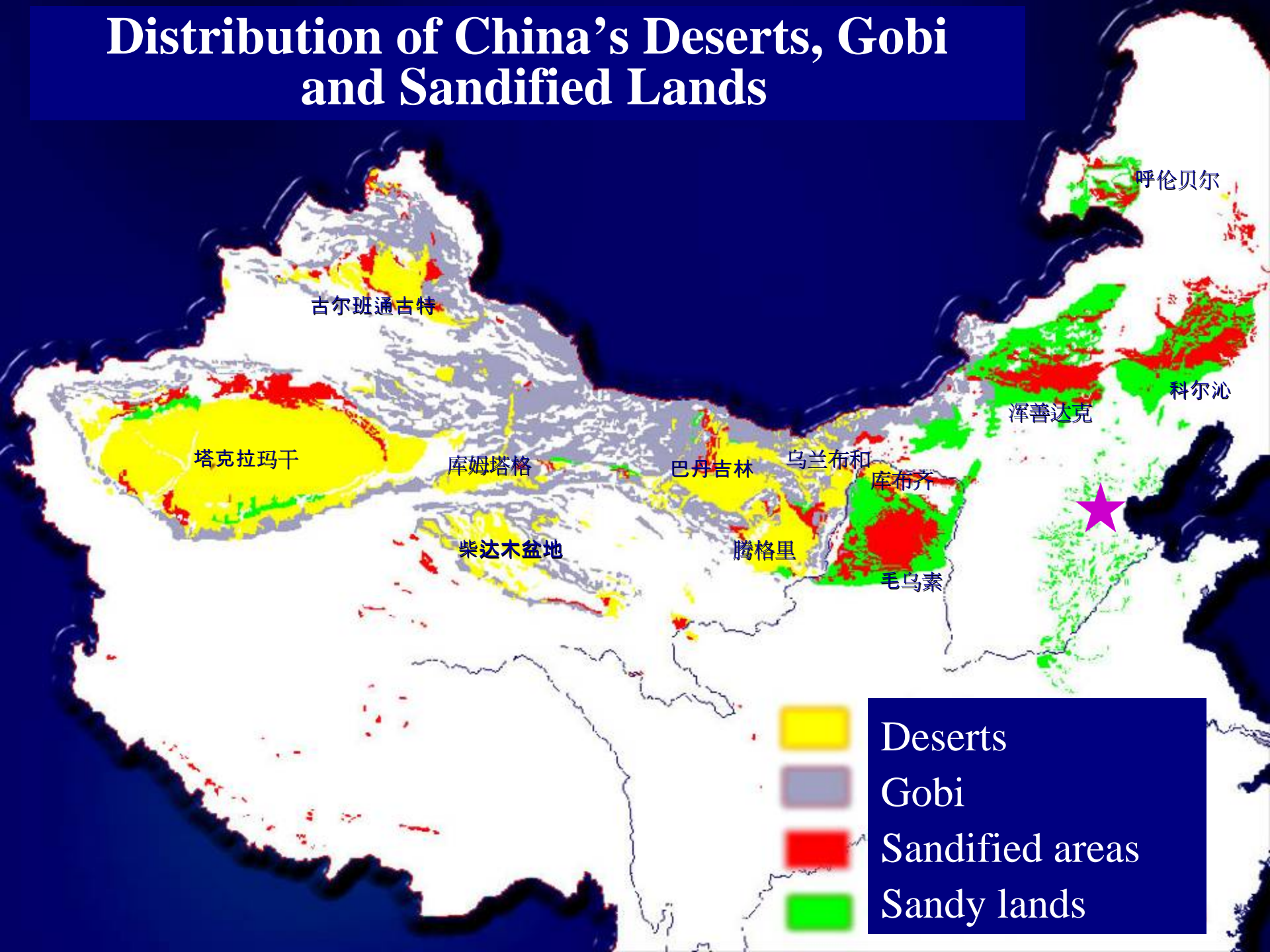
I. Status of Desertification and Dust & Sand Storm



China is one of the countries most severely impacted by desertification, as 37.2% of the country's territory—some 3.57 million km²—is classified as drylands (including hyper-arid, arid, semi-arid and semi-humid arid areas). Of the drylands, 2.64 million km² falls under the category of desertified land in accordance with the definition of the UNCCD, and these desertified lands are distributed in 18 provinces and account for 27.5% of the country's landmass. China's desertified lands can be largely attributed to wind erosion, water erosion, salinization, and freezing-thawing processes. Over 400 million residents are affected by desertification, and the annual direct economic losses exceed 64 billion yuan (Ci Longjun & Wu Bo, 1997; Zhu Lieke, 2006).

中国作为世界上受荒漠化影响最为严重的国家之一，旱地面积约357万平方公里（占国土面积的37.2%，包括极端干旱区、干旱区、半干旱区和亚湿润干旱区），其中约264万平方公里归属联合国防治荒漠化公约定义的“荒漠化土地”；主要分布在全国18个省、区、市，分属风蚀、水蚀、盐渍化、冻融等几大类型。超过4亿人生活在荒漠化地区，每年因荒漠化造成的直接经济损失超过640亿元。

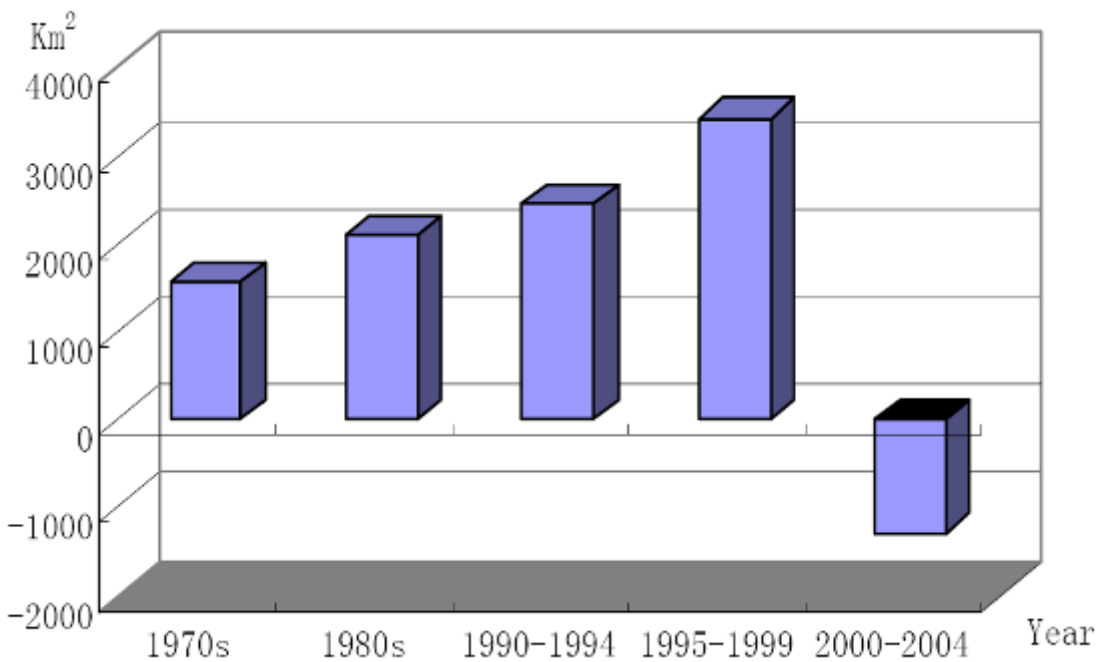
Distribution of China's Deserts, Gobi and Sandified Lands



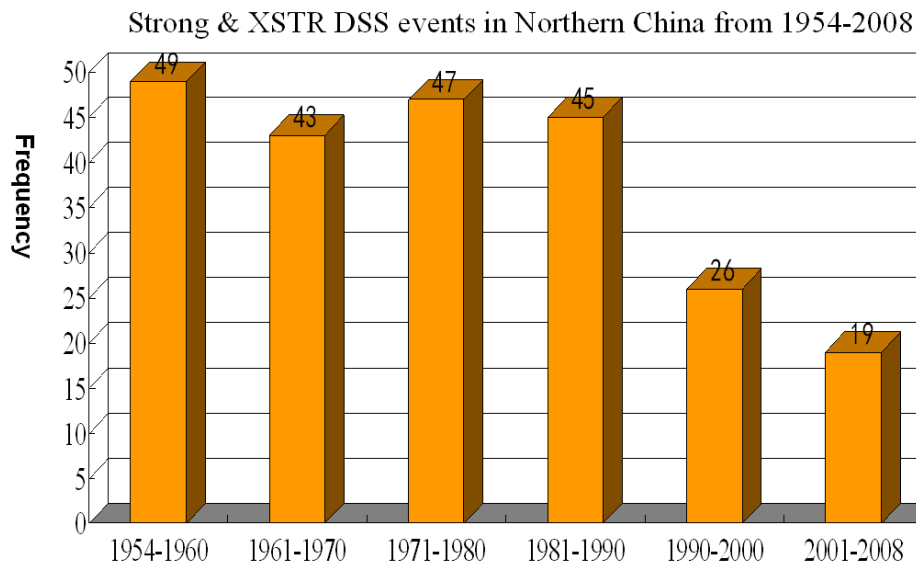
Desertification and Sandification Areas in China

(*in million km²*)

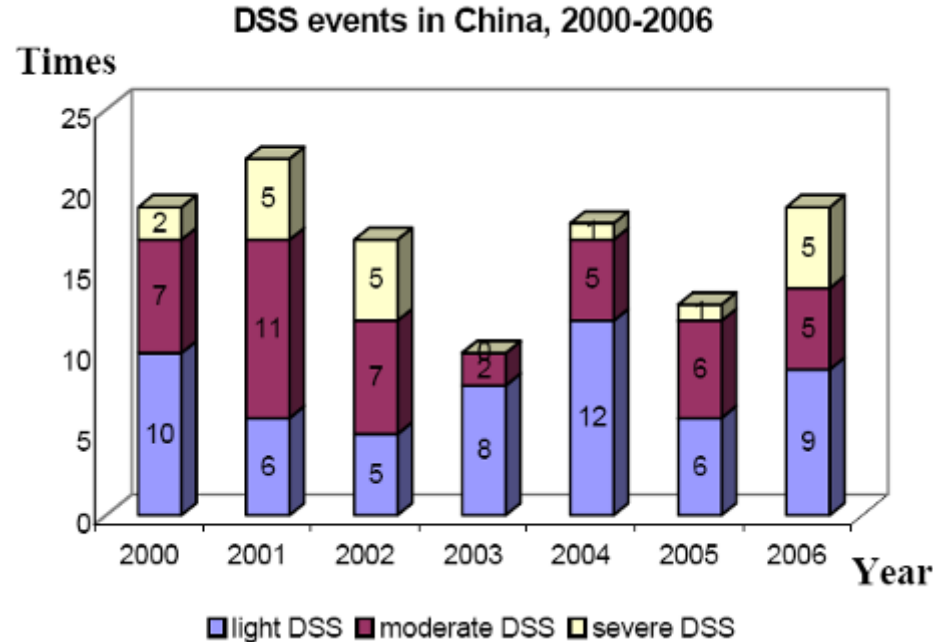
Inventoried year	Desertification	Erosion	Sandification
1994	2.622	1.607	1.714
1999	2.674	1.873	1.743
2004	2.636	1.839	1.740
2009	2.624	1.832	1.731



Annual change of sandified areas

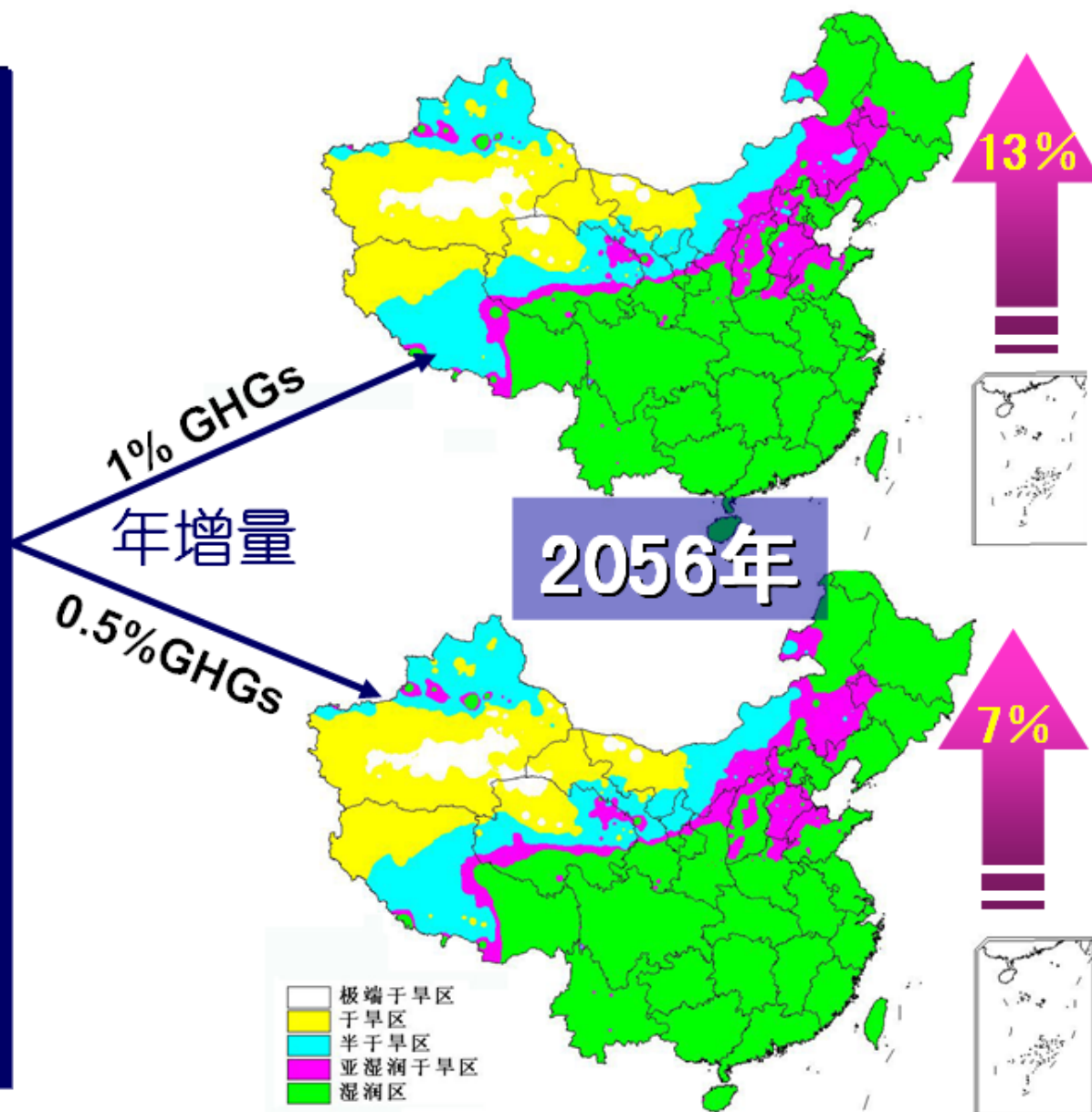


Recent trend of dust-sand storms



Two Scenarios of Desertification Projection

采用1914个气象站的基准数据，利用HadCM2模型对不同气候变化情景下我国生物—气候区的变化进行了预测，为中国应对气候变化和荒漠化的双重影响提供了数量化依据。



II. Combating Desertification —Accomplishments and the Contributive Factors

Accomplishments

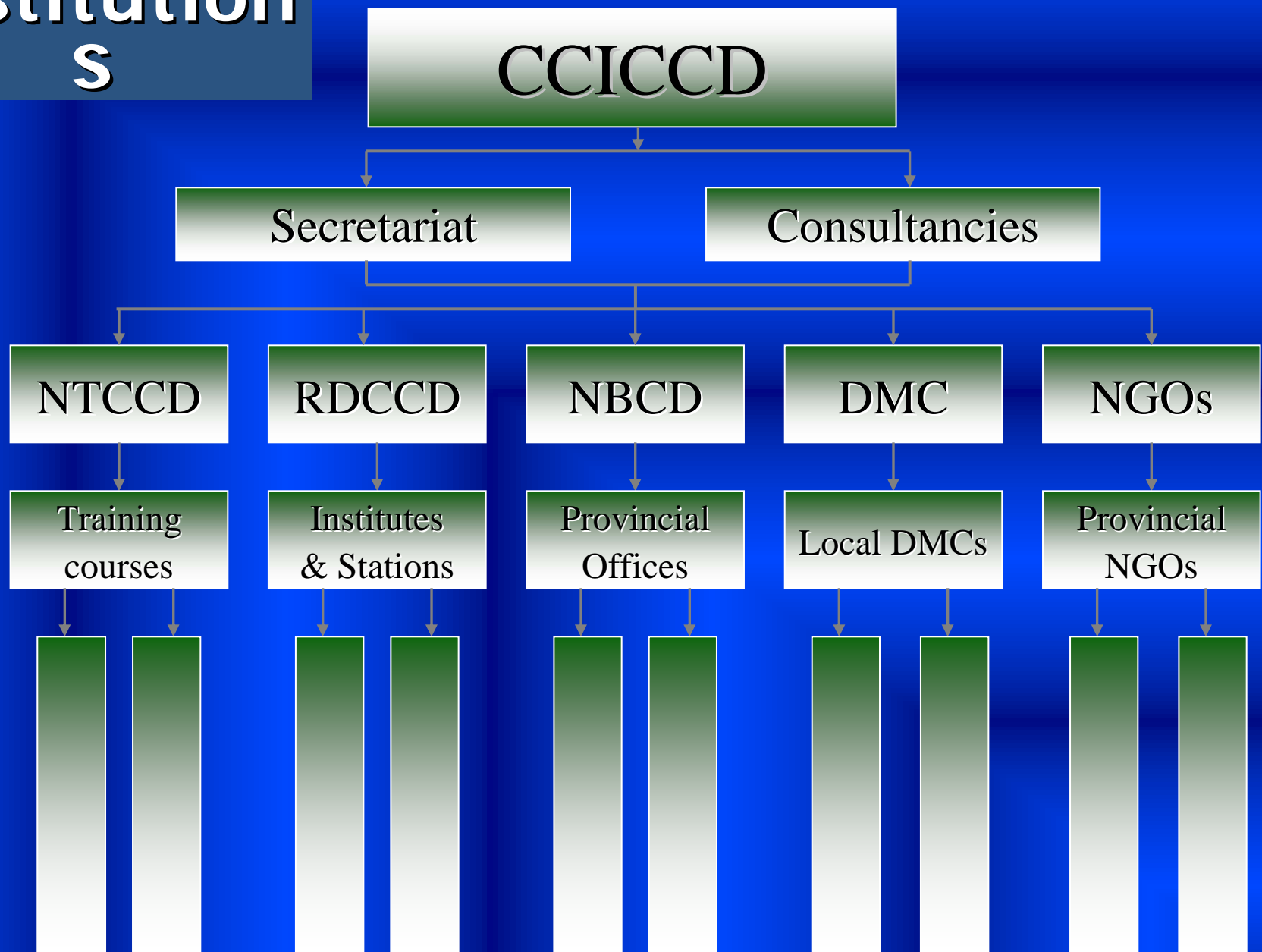
- Institutions
- 20+ % desertified land rehabilitated
- Monitoring and early-warning systems

Contributive Factors

- Government Steering
- Science & Technology support
- Law enforcement
- Correct incentive

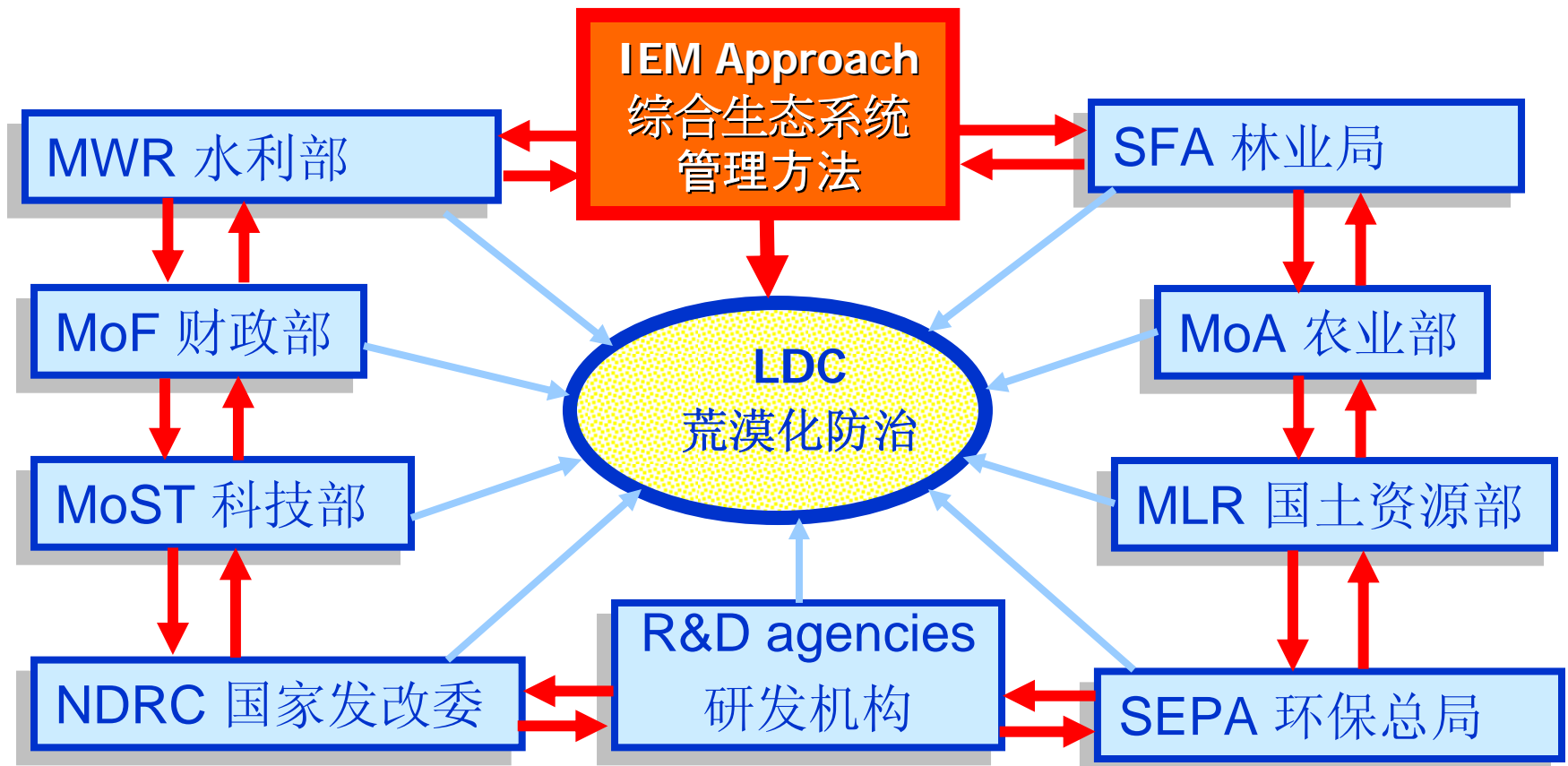


Institution S



Solution to Desertification: Strengthen Institutional coordination 解决方案：加强机构间协调

Agencies involved in LDC 与荒漠化防治有关的机构





■ 中国治沙的实践可以追溯到20世纪50年代。特别是最近30年，先后通过“三北防护林”工程（1978）、全国防沙治沙工程（1990）、环京津风沙源治理工程和退耕还林还草工程（2000）等一系列国家级生态治理工程的实施，以年均0.024%GDP的投入,治理和修复了大约20%的荒漠化土地。

- China's desertification mitigation efforts began in the late 1950s. Through a number of high-profile programs, such as the Three-North Shelterbelt Development Program initiated in 1978, the National Program on Combating Desertification initiated in 1990, the Sandification Control Program for Areas in the Vicinity of Beijing and Tianjin launched in 2000, and the Conversion of Croplands to Forests and Grasslands Program initiated in 2000, the Government of China has poured on average 0.024% of the country's annual gross domestic product (GDP) into desertification mitigation efforts and, as a result, some 20% of the desertified lands have been brought under control.

Monitoring & early-warning system

Three National-Wide Desertification Surveys

- ◆ 1th Survey from 1994-1995
- ◆ 2th Survey from 1999-2000
- ◆ 3th Survey from 2004-2005



中国沙尘暴监测预警服务系统一期工程
CE318太阳光度计布点图



Monitoring Network and Early Warning System

DSS Early-Warning system

- ◆ Satellite level
- ◆ 10-100 m Air level
- ◆ Ground level



国家卫星气象中心



Contributive Factors

- **Government Steering**
- **Science & Technology support**
- **Law enforcement**
- **Correct incentives**

Government Steering

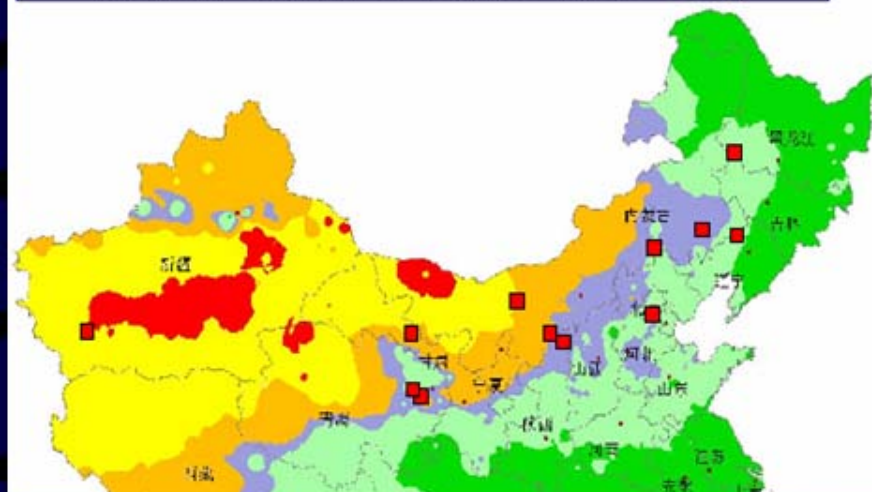
- Long-term strategy(30-50 years) : Three-Norths, NAP
- Medium-term Programming(10-20 years) : projected
- 10th 5-Year Plan and Projects:

- National Plan for Eco-environmental Improvement
- National Program for Eco-environmental Protection
- Western Development Strategy (WDS)
- “Three Norths” Shelterbelt Program (4th stage)
- Sandification Control Program for Areas in the Vicinity of Beijing
- Conversion of Cropland to Forest and Grassland Program
- Grassland Rehabilitation Project.....

- 目前，以现有技术评估，可治理的沙化土地约有 $50 \times 10^4 \text{ km}^2$ 。考虑到全球变暖的影响，预测未来50年需要治理的荒漠化土地面积大致在 $55 \times 10^4 \sim 100 \times 10^4 \text{ km}^2$ 之间。若按照每年 $1.5 \times 10^4 \sim 2.2 \times 10^4 \text{ km}^2$ 的治理速度，大约需要45~70年之久。规划安排到2015年治理 $22 \times 10^4 \text{ km}^2$ 、到2030年治理面积再增 $33 \times 10^4 \text{ km}^2$ ，到2050年治理完成 $100 \times 10^4 \text{ km}^2$ 荒漠化土地中余下的 $45 \times 10^4 \text{ km}^2$ 。规划还同时强调，要实施综合治理措施，防、治、用并举，恢复植被与发展经济、改善民生相结合。
- Approximately $50 \times 10^4 \text{ km}^2$ of the existing desertified lands are considered restorable given current technology. When the potential desertification increments induced by global warming are taken into account, the overall area of desertification that is subject to restoration and mitigation in the future planning horizon is projected to range from 55×10^4 to $100 \times 10^4 \text{ km}^2$. With the approximate restoration rate of $1.5 \times 10^4 \sim 2.2 \times 10^4 \text{ km}^2$ per annum, China's anti-desertification battle is expected to last some 45~70 years. The current strategic plans set restoration targets at $22 \times 10^4 \text{ km}^2$ by 2015, with an additional $33 \times 10^4 \text{ km}^2$ by 2030, and the final $45 \times 10^4 \text{ km}^2$ of the $100 \times 10^4 \text{ km}^2$ restored by 2050. The plans also specify a number of cross-cutting strategies to integrate vegetation rehabilitation and planting for the improvement of local livelihoods and promotion of economic development. The mitigation approaches are required to reflect local conditions and to combine prevention, restoration and utilization.

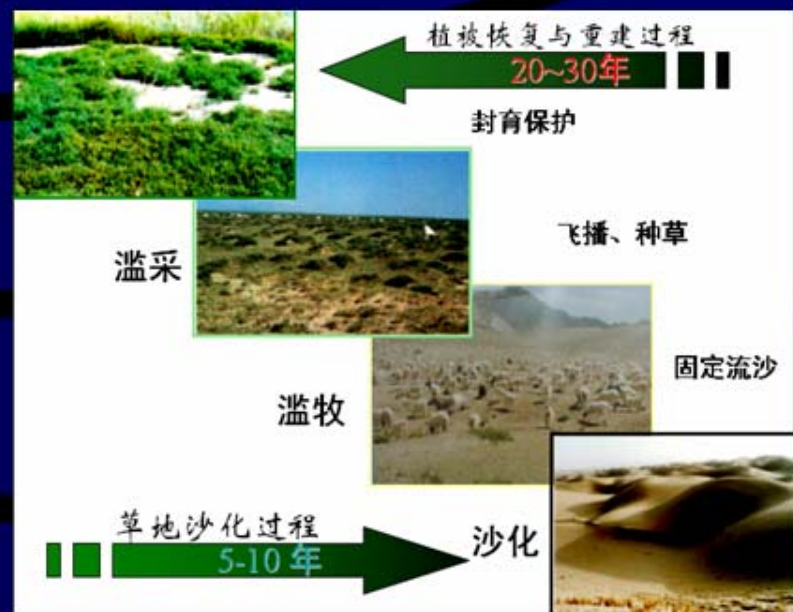
全国防沙治沙试验示范基地分布图

(刘硕编绘, 底图依据吴晓等中国荒漠化气候分区-2003版)



基地名单

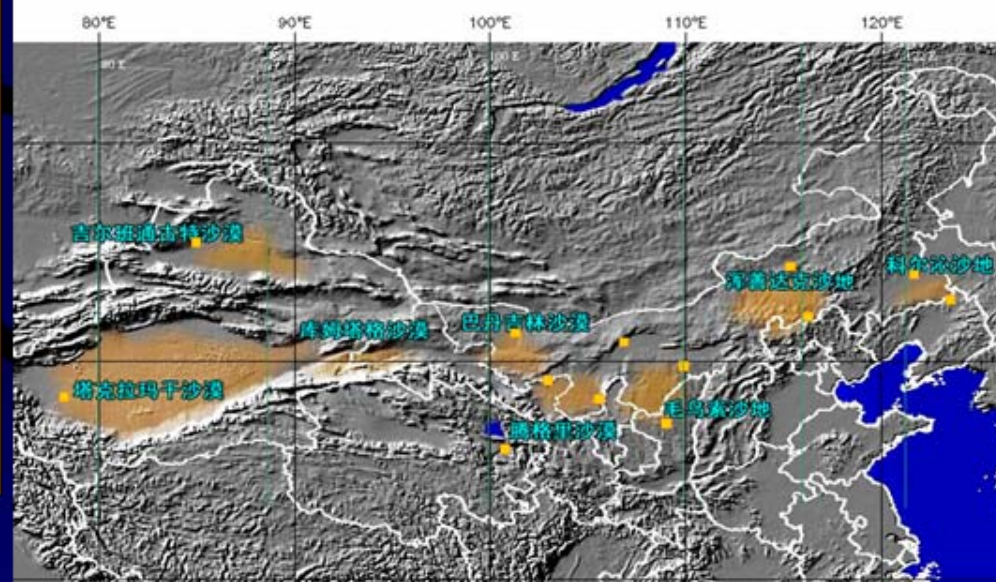
北京大兴
甘肃临泽
黑龙江泰来
辽宁章古台
内蒙古磴口
内蒙古多伦
内蒙古鄂尔多斯
内蒙古赤峰
青海沙珠玉
陕西榆林
新疆和田

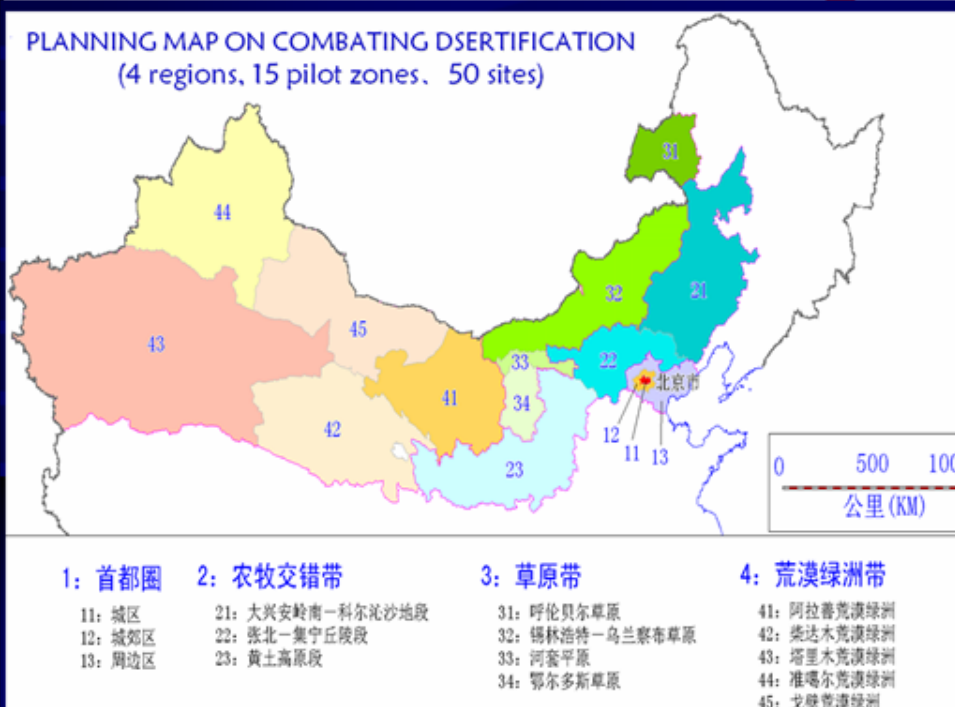
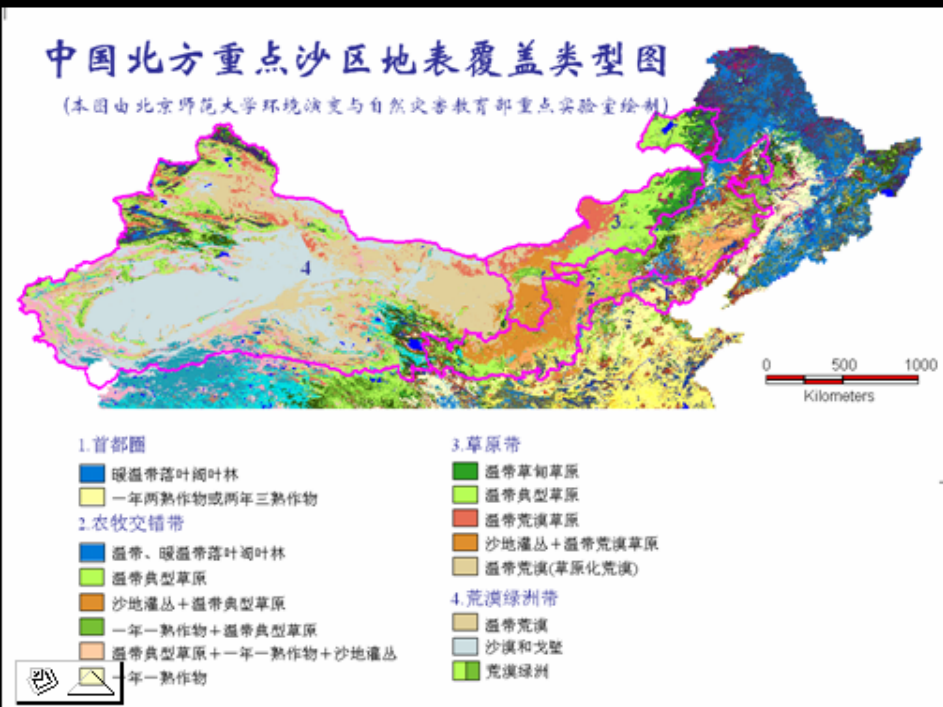
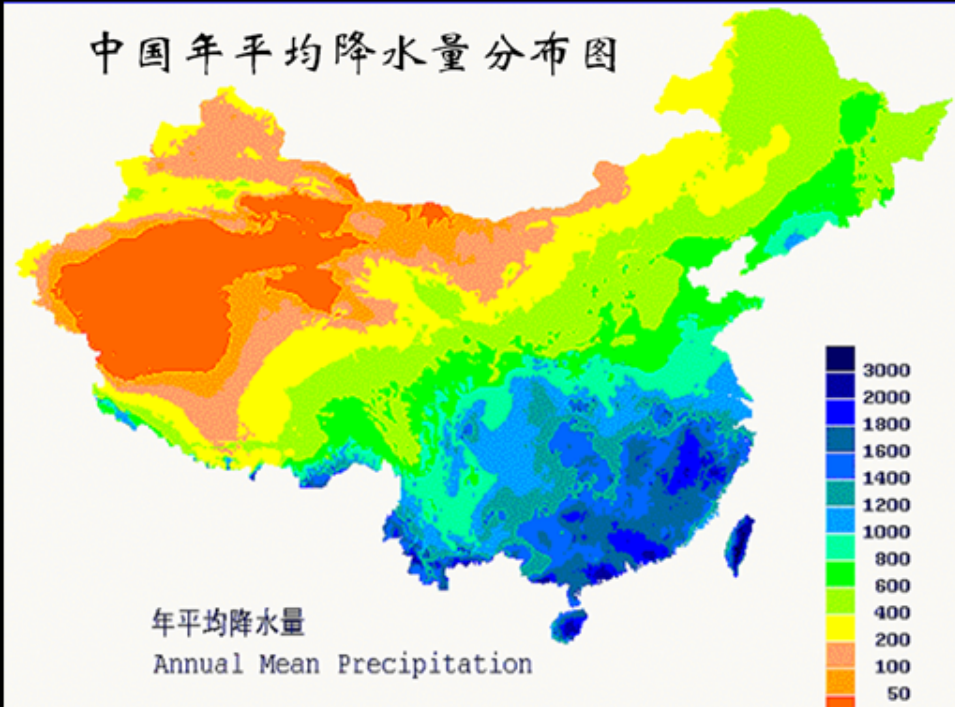
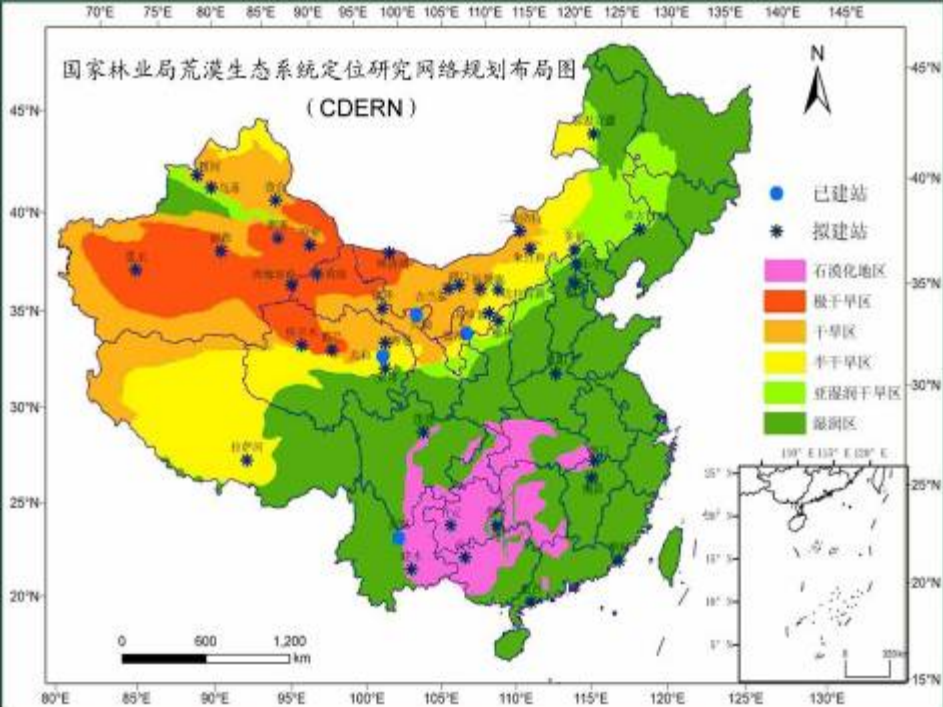


S & T Support

- Long-term research stations
- Demo sites desert control
- Integrated techs model/system

DISTRIBUTION OF LONG-TERM OBSERVATION/RESEARCH STATIONS IN CHINA





Guaranteed by Law & Policies



International

- Agenda 21
- UNCCD
- UNFCCC + Kyoto Protocol
- UNCBD
- Ramsar
- IFP/IFF
-



National

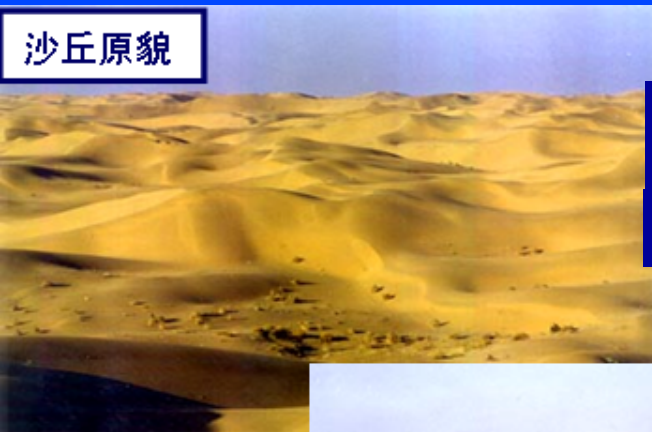
- Agenda 21 in China
- Forestry Action Plan of Agenda 21 in China
- Law on Combating Desertification
- Law on Conservation of Soil and Water
- Law on Grassland
- Law on Forest
- Regulations on the Conversion of Cropland to Forest
-



中国 21 世纪议程

林业行动计划

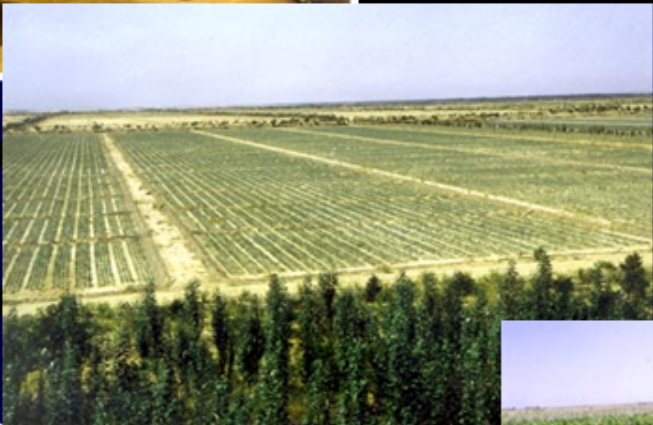




沙丘原貌

Correct Incentives

Encourage private sector's development of sandylands



From desert
plantation to
industries





Fodder Products



Correct Incentives

Encourage private sector's development of sandylands



Correct Incentives

Encourage private sector's development of sandylands

Sand as materials



Correct Incentives

Encourage private sector's development of sandylands



Simply greenhouse



Modern greenhouse



Greenhouse
products

III. Case studies of technologies & their integration on combating desertification

Technologies

- **Dune fixation** = physical/chemical/biological
- **Afforestation** = enclosure/air-seeding/tree-planting
- **Highway protection** = integrated
- **Railway protection** = integrated

Technological Integration (technological “bundles”)

- **Prevention** = preservation/conservation/protection
- **Rehabilitation** = agroforestry/shelterbelt
- **Utilization** = material/medicine/food/energy source



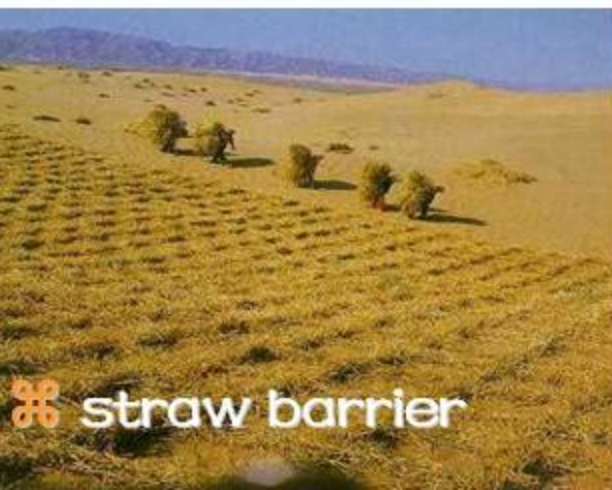
⌘ Plastic-net cover



⌘ fencing barrier



机械沙障固沙技术 Sand fixation: physical



⌘ Stone barrier

⌘ straw barrier

⌘ Clay barrier



Dec, 2002 in Iran

化学材料固沙技术

Sand fixation: Chemical



Dec, 2002 in Iran

18 12:22



April, 2001 in Duolun, China



Aug, 2003 in Duolun, China



生物活沙障固沙技术
Sand fixation: Biological



(国家“九五”重点科技攻关“荒漠化治理技术研究示范”项目提供)







飞播造林种草技术



Afforestation: air-seeding

Afforestation: tree-planting



塔干沙漠公路防沙治沙

(肖洪浪提供)



Highway protection = integrated



铁路防沙固沙造林技术

Railway protection = integrated



荣获国家科技进步特等奖
中国科学院科技进步一等奖



铁路穿越腾格里

安然度过40年

五带一体铁路治沙

- ✂ 卵石防火带
- ✂ 灌溉造林带
- ✂ 草樟植物带
- ✂ 封沙育草带
- ✂ 前沿阻沙带



Technical Bundles

➤ Prevention

=preservation/conservation/protection

➤ Rehabilitation

=afforestation/agroforestry/Kulum

➤ Utilization

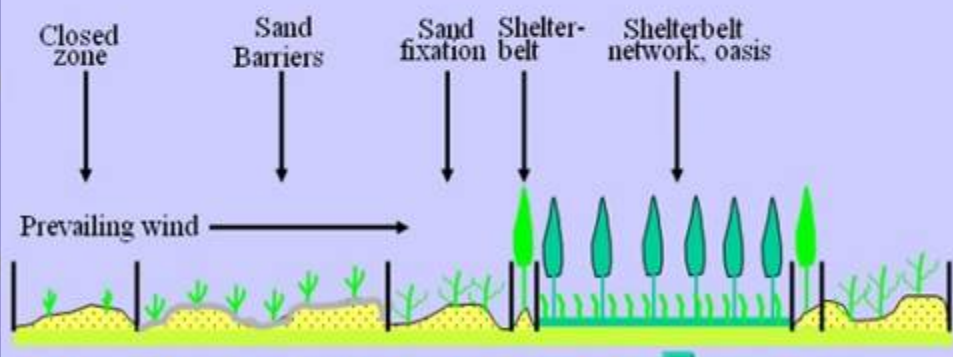
=material/medicine/food/energy source

Preventions





The transect of an agroforestry system in oasis and its periphery



窄林带—小网格农田防护林
Agroforestry---Shelterbelt and Intercropping





Kulums



⌘ 以户为单位建立“小生物圈”

⌘ 以村为单位推广“多元系统”

⌘ 以乡为单位推广“生态网”



Renewable Energies

Herb Planting



Institutes



Farmers



Further Reading References

- ***Rangeland Degradation and Recovery in China's Pastoral Lands***, England: CABI publisher, 2009
- ***Best Practices for Land Degradation Control in Dryland Areas of China***. China Forestry Press, Beijing 2008
- ***Regional Review of UNCCD Implementation and Best Practices in Asia and the Pacific -- Case Studies from Australia, China, Mongolia, Thailand and Viet Nam***. Beijing: Chinese Environmental Science Press, 2005
- ***Traditional Knowledge and Practical Techniques for Combating Desertification in China***, Beijing: China Environmental Science Press, 1999

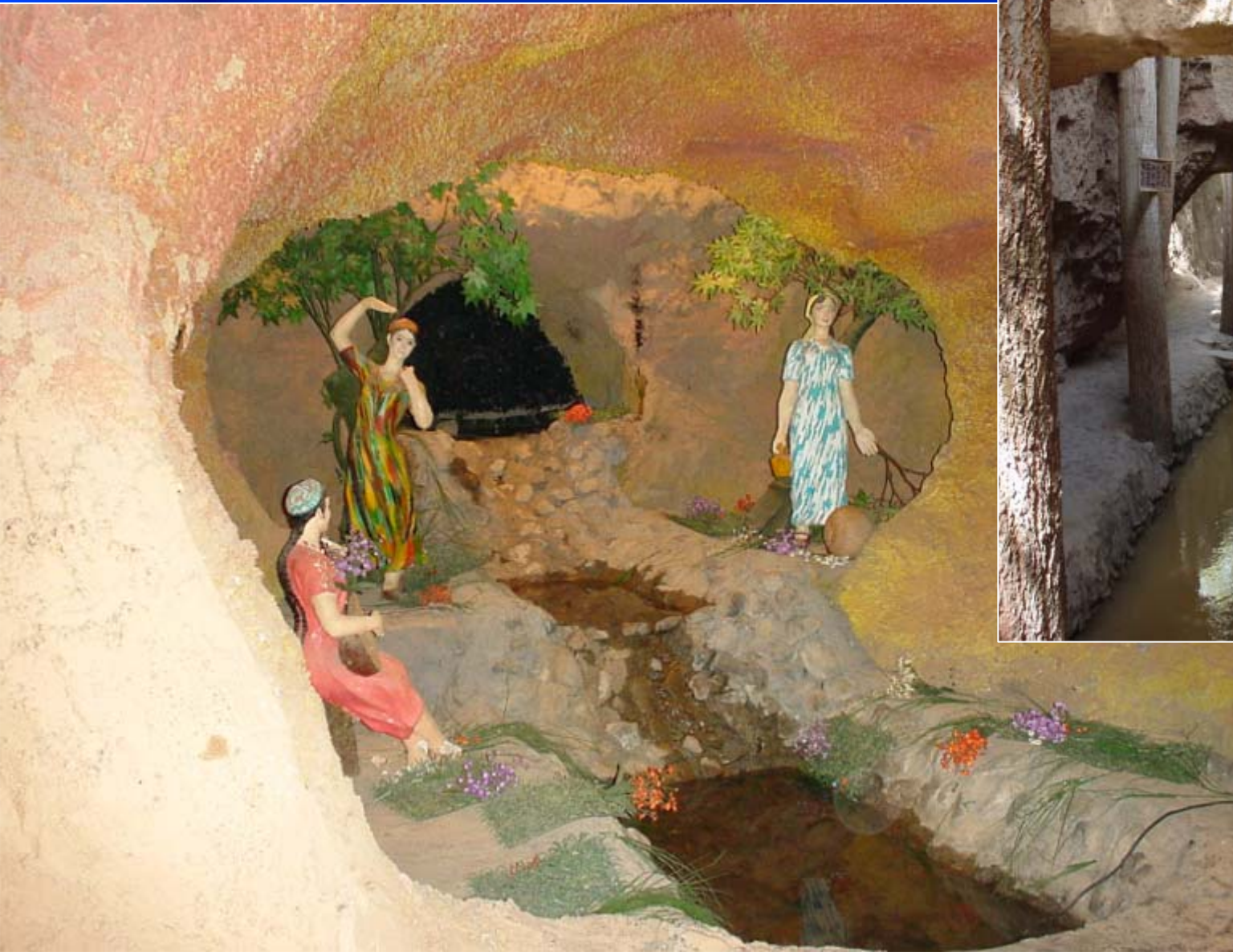
Eco-functions of Chinese traditional culture

- Kanjing (under channal & well)
- Shatian (stones field)
- Religion & Temple
- Tomb....



- kanjing

- kanjing





• Shatian (stones-covered field)

- Shatian (stones field)





•Religion & Temple



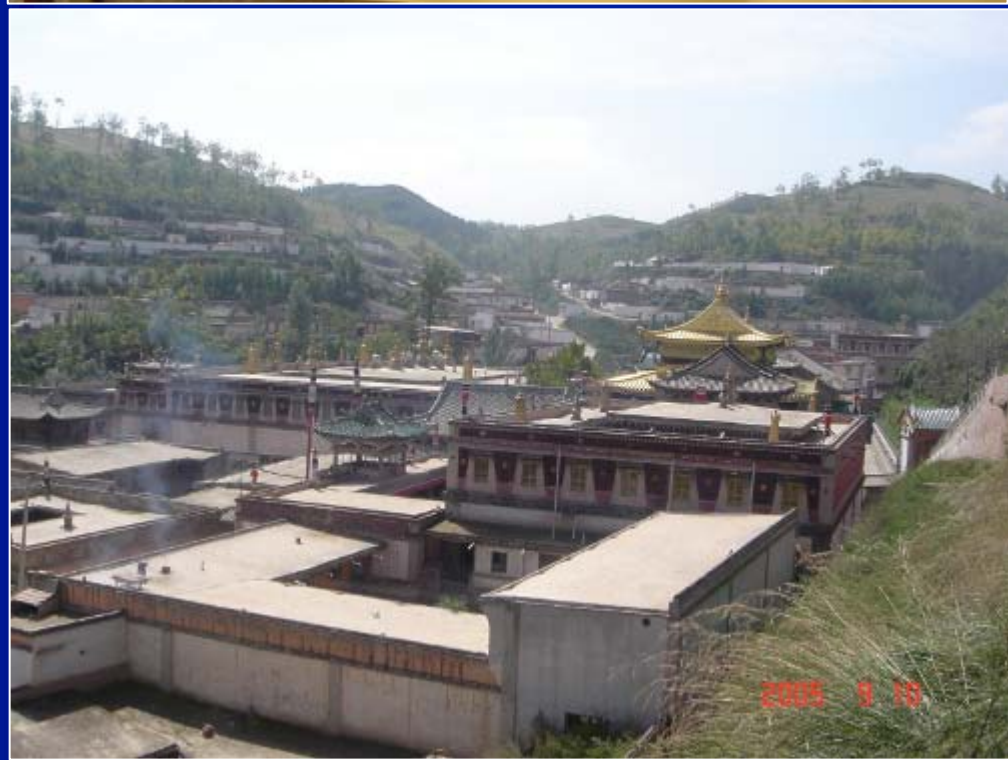


成吉思汗丰功伟业

成吉思汗，名铁木真，生于漠北高原，九岁时父亲也速该为其订亲，在归途中遇害身亡，少年时多遭磨难，曾被泰亦赤兀部抓获后脱身，之后立志创业，终于在1206年建立蒙古汗国，其后又进行了西征和攻金灭西夏的战争，客观上促进了东西方经济文化的交流，为建立元朝奠定了坚实的基础。

Genghis Khan: a Person With Extraordinary Achievements

Genghis Khan, whose family name was Borjigin, was born in a herdsman family on the vast grassland of the northern plateau of northern China. Genghis Khan had a difficult time when he was young. He was kidnapped by his enemy when he was 12 years old. After that, the young Temüjin was kidnapped by the enemies from the west, and then fortunately managed to escape. Upon the bitter experiences, Temüjin was determined to pioneer his cause to unite the Mongolian tribes. In 1206, he set up the Mongol Kingdom of Mongolians. Afterwards, he and his army marched westward to attack the Jin Kingdom and the Xia Kingdom. The victories laid a sound foundation for the establishment of the Yuan Dynasty, which promoted the economic and cultural exchange between the West and East.





Saishand,
Mongolia



Different Worship

Alxa,
Inner Mongolia
PRC



A wide-angle photograph of a desert landscape. The foreground is filled with sand dunes that have been sculpted by wind, creating a series of parallel, wavy ridges that stretch across the frame. The sand is a warm, golden-brown color. In the middle ground, a flat expanse of desert floor leads to a range of larger, more rounded sand dunes in the distance. The sky above is a clear, pale blue, with a very slight gradient from top to bottom. The overall scene is one of vastness and tranquility.

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