中国的草原——其生态系统服务及若干问题——

高 玉 葆

・中国的草原面积 4 亿 ha，占国土面积的41%，分布在东北部、北部、西部和西南部。草原气候温暖、土壤为栗色土、泥炭。集中分布的是温带和亚热带的草原。地形上，内蒙古草原分布在蒙古草原的外侧，其东面、东南面是大兴安岭、南面是阴山山脉、其南面是黄土高原。

・正如在照片上看到的，其辽阔风景不禁让我们联想到古诗“天苍苍，野茫茫，风吹草低见牛羊”。植物性是禾本草类，有很高的生产力。草原是一个生态系统。该生态系统的生产者是绿色植物、消费者是被放牧的动物和野生动物。当然，人也是消费者，而且是最重要的消费者。土壤中有动物、微生物等的分解者。

・草原作为一个生态系具有服务功能（system service）。这个功能极大，首先是提供乳、肉、皮、毛。而且草原还有创造环境的作用。草原是保存生物多样性的基地，是二氧化碳的重要储存库。

・草原虽然吸收二氧化碳。但是，气温上升的话，草原的生产能力也可能增加，放牧动物、野生动物的消费也可能增加，所以我们还不清楚整体上的碳的收支。现在的气候和过去大不一样，旱灾、碱化、沙尘暴等的灾害在增多。

・草原的主要的自然灾害可以用三种颜色来表示。第一，旱灾（黑色灾害）；第二，风雪灾害（白色灾害）；第三，蝗灾（黄色灾害：蝗与黄同音）。

・现在的草原处于被过度利用的状态。其主要原因是放牧频率过高，放牧动物过多。观光旅游、道路修缮、煤及石料的开采、中药药材的采摘、野生动物的捕获杀害等等影响着草原。其结果是带来了人类生存环境的丧失、分割、退化、绿色植物生产能力的下降、放牧动物生产量的减少、生物多样性降低、土壤退化、草原、湿原野的价值降低。

・草原科学的研究已经明确表明内蒙古草原现在已经是持续不可能的系统。其原因之一是过去50年间激增的人口及随之的乳、肉、皮、毛、蛋的需求增加。

・作为其对策，从粗放型的放牧转换为畜舍饲养、大规模的创造人工草原以便使天然草原得以修养的计划正在被推进。而且牧草少的季节里，从内地运送饲料到草原以喂养家畜。努力深化畜产加工和发展药草加工，以增加农牧民的就业机会。

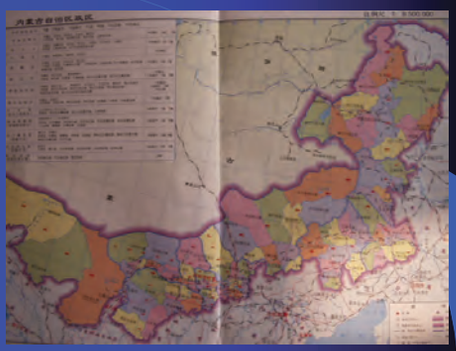
只有让空腹变饱之后沙漠化的改善、草原的发展才能成为可能。中国的草原现状已不容乐观，但我想还是有改善之策的。

Grassland in China: Ecosystem Service and Problems

Yubao GAO
School of Life Sciences
Nankai University, Tianjin, China
October 30, 2003

Grassland in China: General

Area: 400 million ha, 41% of the total land area
Geographical distribution:
Northeast, North, Northwest, West, Southwest
Climate: temperate (warm, typical, cold)
monsoon
Soils: chestnut, peat
Landscape: Vast, flat or hilly, trees rarely seen
Sub-types: Meadow steppe, typical -, desert s-,
Meadow, alpine meadow



Grassland as an ecosystem

Primary production by green plants:
- Meadow steppe: 400-1200 g/m^{-2}/year
- Typical steppe: 300-600 g/m^{-2}/year
- Desert steppe: 20-100 g/m^{-2}/year

Secondary production by grazing animals:
- Sheep, goats, cattle, horses, camels

Decomposition by microbes and invertebrates

Ecosystem service by grassland

Food supply: Milk, meat, wool, leather
Landscape formation: open, green, boundless
Biodiversity conservation:
genes, species, ecosystems
Carbon storage: CO_2 absorption and fixation

Grassland under climate change

CO_2 enrichment and temperature increase:
Possible consequences:
Higher herbage yield mainly from C3 plants
More consumption by animals and pests
Drought: prolonged, more frequently happened
Wind erosion: more likely to occur
Dust storm: source of dust affecting far-away areas including Beijing and Tianjin

Natural disasters in grassland

Drought ---------- “black disaster”

Heavy snow in winter --- “white disaster”

Grasshopper
population outbreak --- “yellow disaster”

Over-used grassland

Too many grazing animals in the grassland:
- Well above the livestock carrying capacity

Tourism development in well-conserved areas
Roads construction through the grassland
Coal and stones mining
Picking and digging of Chinese herbs
Hunting for animals of high commercial value

Grassland in degradation

Habitat loss or fragmentation
Lower production by green plants
Smaller amount of output by domestic animals
Reduction in biodiversity
Poor quality of soils
Decreased palatability of forage species
Species replacement in plant community:
- Dominant species lost their dominance
- High quality grasses replaced by non-desirable herbs

Inner Mongolia steppe: an ecosystem unable to sustain itself

- Population increase over the last 50 years
- Increased demand for milk, meat, wool, leather
- More domestic animals to be fed
- Forage in short supply, particularly when there is a prolonged drought

Try to find a way to solve the problems?

From field grazing to barnyard feeding
Artificial grassland establishment
Transferring animals from grassland to cereals-farming areas where straws are used as a substitute for forage
Food supply from outside the system to balance the need of pen-fed animals
Job creation for local grassland farmers by investment of industry of animal products

National Key Project (973) in progress

To work out a model of agro-pastoral system: Land use planning, landscape design
To determine the upper limit of water use for ecological safety in some vulnerable areas, particularly in agro-pastoral ecotone zones
To select more adaptable germplasm resources for cultivated grassland
To find better ways to prevent the grassland from further degradating