

## DESERTIFICATION IN CHINA

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### Summary

China is a developing country with a vast areas affected by desertification. Especially in northern China, sandy desert has been spreading rapidly over a vast surface. From the end of the 1950s to the middle of the 1970s about 39 000 km<sup>2</sup> of sandy land suffered from desertification at a speed of 1560 km<sup>2</sup>/year. The phenomenon then increased by 25 200 km<sup>2</sup> from 1975 to 1987, at an average rate of 2100 km<sup>2</sup>/year. In the 1990s, this accelerated further to 2460 km<sup>2</sup>/year.

The desert-affected land in China is mainly located in the semi-arid agro-pastoral transition region, the semi-arid undulating sandy grasslands, and the arid oases and lower reaches of inland rivers in north and northwest China. Climatic variation and human factors are the main causes of desertification in China. Factors related to human activities have been found to be most important. They include: population growth, the pressure of economic development, poor awareness of environmental protection, misuse of water resources, over-cultivation, over-grazing, undue collection of fuel wood, and inappropriate farming on slopes.

### 1. Introduction

Desertification is a process of environmental deterioration in arid, semi-arid and dry sub-humid areas due to their fragile ecological conditions and irrational economic human activities. Desertification results in desert-like landscapes and in significant reduction in productivity. Furthermore, desertification has been blamed for causing severe dust storms in China. Three types of desertification can be distinguished: sandy desertification of grassland, reactivation of fixed sand dunes, and sand dune encroachment.

Desertification is one of the most serious environmental and socio-economic problems in the world today, and China is a developing country with vast desert-affected areas, covering in total 471 counties in 18 provinces and autonomous regions. Desertification caused by wind erosion is called sandy desertification in China. Especially in northern China, sandy desertification has spread rapidly over large areas. It mainly appears in steppes, desert steppes, and other arid zones such as riverbanks in the desert marginal belts and in lower reaches of rivers in deserts.

By analysing aerial photographs of the deserts in China, Zhu and Wang (1993) concluded that the area affected by sandy desertification increased from 137 000 km<sup>2</sup> from the end of the 1950s to 176 000 km<sup>2</sup> in the mid 1970s. About 39 000 km<sup>2</sup> of sandy land was desert-affected at a rate of 1560 km<sup>2</sup>/year during that period. These authors also found that the area of sandy desert-affected land increased by 25 200 km<sup>2</sup> from 1975 to 1987, at an average rate of 2100 km<sup>2</sup>/ year. In the 1990s, this accelerated to 2460 km<sup>2</sup>/year—an annual loss of land equivalent to a medium-sized county in China.

## 2. Severity of Desertification

The most important action to start with in monitoring desertification is to establish a classification system based on criteria of land degradation related to specific desertification processes. Based on studies in northern China, Wang *et al* (1999) pointed out that these criteria (a) should give a clear description of the state of desertification; (b) be easily observed; (c) be widely used; (d) be sensitive to changes of state; (e) be repeatedly used, and (f) be expressed in quantitative terms.

Severity Class	Area of wind erosion (%)	Increase in area of wind erosion (%)	Vegetation cover (%)	Reduction of biomass per year (%)
Slight	<5	<1	>60	<1.5
Moderate	5 - 25	1 - 2	60 - 30	1.5 - 3.5
Severe	25 - 50	2 - 5	30 - 10	3.5 - 7.5
Very severe	>50	>5	<10	>7.5

Table 1. Direct criteria of desertification in China.

Severity class	Erosion thickness (cm) <sup>1</sup>	Deposition thickness (cm) <sup>1</sup>	Blowout rate (t/ha/ yr)	Human population capacity (%) <sup>2</sup>	Livestock population capacity (%) <sup>2</sup>
Slight	<5	<5	<0.5	-50 to -30	-50 to -30
Moderate	5 to 10	5 to 10	0.5 to 1.0	-30 to 0	-30 to 0
Severe	10 to 20	10 to 20	1.0 to 3.0	0 to 31	0 to 31
Very severe	>20	>20	>3.0	>31	>31

1. Average measurements over a given area.
2. Criteria value = (Capacity-Actual)/Capacity x 100

Table 2. Indirect criteria of desertification in China.

The criteria currently used in China are: (a) percentage of wind erosion or deposition area to the total area; (b) percentage increase of area of wind erosion or deposition during a particular period; (c) percentage of vegetation-covered area to total area; and (d) percentage reduction of biomass during a particular period (measured by remote sensing). Table 1 shows a matrix of desertification criteria. The columns express the four criteria, and the ranks show the severity of each criterion. These criteria can be directly used to measure the degree and area of desertification and are therefore called direct criteria of desertification. There are also indirect criteria which are useful in practice (Table 2).

Using the above-mentioned classification system, Zhu and collaborators (1989, 1994) studied the severity and degree of desertification in the middle part of the agro-pastoral transitional area in northern China. They found that slightly, moderately and severely desert-affected land covered 84.24%, 14.87% and 0.89% respectively of the total studied area (status in the mid 1970s). These figures were 76.43%, 21.80% and 1.77% respectively in the mid 1980s. From these observations they concluded that moderately and severely desert-affected land was spreading rapidly, and that the agro-pastoral transitional area in particular was in the process of desertification. A sandy desertification map of China at a scale of 1 : 4 000 000 was compiled based on the 1 : 500 000 maps of all the studied areas (see Figure 1).

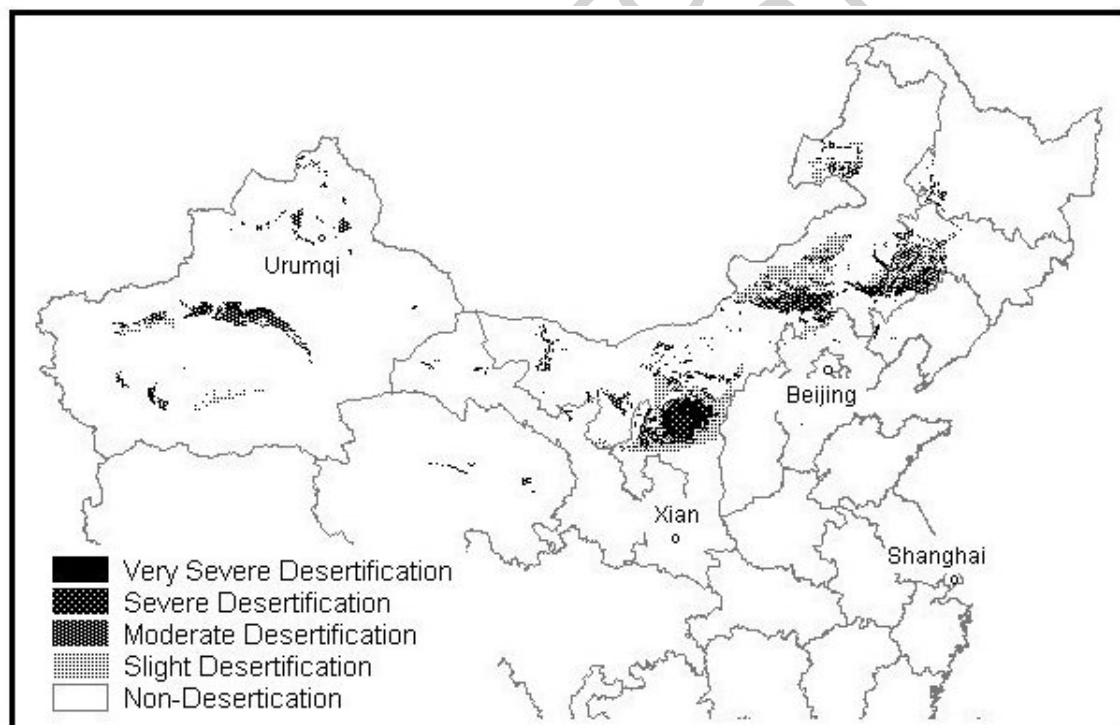


Figure 1. Map of sandy desertification in northern China

Source: Zhu, 1984; Wang *et al*, 1995.

### 3. Distribution of Desert-Affected Land

The desert-affected land in China is mainly located in three regions in the northern part of the country (see Table 3):

- The semi-arid agro-pastoral transition area, especially the cultivated grassland, occupying 40.5% of the total desert-affected land area of northern China;
- The semi-arid undulating sandy grasslands, in which desert-affected land occupies 36.5% of the total desert-affected land area of northern China;
- The arid oasis margin and lower reaches of inland rivers, in which desert-affected land occupies 23.0% of the total desertified land area of northern China. The spatial distribution of desert-affected land in the last decades has the following characteristics:
  - Dry farmlands in the sandy steppe region with high rates of ongoing desertification. In the 1990s, desertification of dry farmlands developed at an annual rate of 5 to 10%.
  - Since the 1980s, grasslands have also been desertifying rapidly. For example, in the northern part of Ulanqab league in Inner Mongolia, the desert-affected land area increased from 18.1% in the 1970s to 30.4% in the 1980s. The ground surface became rough, and the quality of grasslands deteriorated.
  - In some desert-affected areas, such as the sandy lands in Horqin and along the Great Wall in Shaanxi province, the desertified area is still progressing at an annual rate of 2 to 5% although some countermeasures have reduced the spread.
  - The construction of open coal mines has caused further serious desertification in recent years. For example, about 62% of the Shenfu coalfield in Shanxi Province has suffered from desertification.
  - In recent decades, desertification in sub-humid regions has become a serious environmental problem. For example, sand dunes have been formed along valleys in south-western China, such as the valleys of the Jinshajiang and Minjiang rivers.

When proper measures were adopted against desertification, the desert-affected area decreased. According to the analysis of remote sensing data (1987 and 1993 Landsat TM data), the desert-affected land area in the Mu Us sandy lands decreased from 32 586 km<sup>2</sup> (67.5% of the total monitoring area) to 30 497 km<sup>2</sup> (63.5% of the area), i.e. about 276.6 km<sup>2</sup> of desert-affected land was recovered to grassland annually during the seven years. Although the effects of desertification were reduced in some areas, the total desert-affected land still increased in China. In the 1990s, sandy desertification accelerated to an average intensification of 2460 km<sup>2</sup>/year in the whole of northern China.

Region	Monitored Area	Desert-affected land in middle of 1970s		Desert-affected land in middle of 1980s		Annual increase in area		Period
	km <sup>2</sup>	km <sup>2</sup>	%	km <sup>2</sup>	%	km <sup>2</sup>	%	
Horqin Sandy Land in Inner Mongolia	112,000	21,567	19.25	23,800	21.25	186	0.82	1975-87
Chifeng (in Horqin Sandy Land)	34,680	7,405	21.35	9,051	26.10	137	1.69	1975-87
Bashang	51,300	2,613	5.09	4,515	8.79	159	4.66	1975-87

region in Hebei Province								
Houshan region in Inner Mongolia	48,530	13,770	28.40	23,000	47.40	769	4.37	1975-87
Mu Us Sandy Land in Inner Mongolia	49,100	43,407	88.30	45,973	93.60	257	0.59	1975-87
Qahar steppe in Inner Mongolia	12,770	3,669	28.70	5,541	43.40	156	3.50	1975-87
Yanchi County, Ninxia	6,760	1,369	20.20	1,846	27.30	48	3.00	1975-87
Yulin County, Shaanxi	21,530	15,308	71.10	13,219	61.40	-232	-1.6	1977-87
Xilin Gol steppe, Inner Mongolia	111,780	13,194	11.80	16,409	14.67	268	1.00	1975-87
Lower reach region of Roushui River	32,200	3,480	10.81	5,955	18.49	225	5.00	1975-86
Piedmont Plain of Kunlun Mt. Qinghai	7,920	4,400	55.60	5,573	70.40	117	2.40	1976-86
Shugui Lake Region in Central Alxa	16,200	1,172	7.23	1,308	8.07	13	1.10	1974-84

Table 3. Development of land desertification in some typical regions in China.

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### Biographical Sketches

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