

Analysis and assessment of Chinese eco-environmental situation

Niu Wenyuan¹

(Received January 22, 1990)

Abstract—In order to give out the correct conclusion for evaluating Chinese eco-environmental situation, in this paper, a special assessmenal procedure has been used to analyse following 7 basic environmental problems: (1) Natural hazards; (2) Soil erosion; (3) Forest shrinkage and grassland degradation; (4) Water resources shortage; (5) Desertification; (6) Environmental pollution; (7) Farmland decrease. The basic strategies for improving Chinese environmental situation have been suggested.

Keywords: environmental analysis; eco-environmental assessment; China.

BACKGROUND

At present, the eco-environmental issue has already become one of the most fundamental factors to hamper the growth of production. In China, the main cause for ecological crisis and environmental deterioration can be reduced to the very frequent natural hazards and large-scale human activities. In such a country with a large population like China the eco-environmental problem seems to be more crucial than the world. Our observations on Chinese eco-environmental problems are based on their historical heritage and dynamic process of development.

China has a long history in exploiting natural resources. The direct result of the activities reflects on the gradual degradation of eco-environmental quantity. Before the Qin Dynasty (2100 years ago), more than 50% of Loess Plateau in China were covered by forest (now the forest cover less than 5%), and the forest-covered area was almost 40-50% of the whole territory (now the average forest covered area is 12%). The rich deposit of mineral resources and vast arable land made it possible to form Chinese ancient civilization. As time goes on and population steadily grows, people must find a way to change their living sites and seek new places for better life. So, eco-environmental problem fell to the very fragile situation of her long history in 1949. In fact, for the thousands of years, big population, excessive cultivation, overherding, overcutting, and overfishing had caused a grave deterioration in forestry, grasslands, crop field

¹Research Center for Eco-Environmental Sciences, Academia Sinica, Beijing 100083, China.

and fishery resources. The soil erosion and shortage of water resources have also led to the danger of land desertification. For instance, the forest coverage of 21% in the beginning of the Qing Dynasty (300 years ago) had been reduced to 7-8 % in 1949. Another example is taken from Nanjing Plains, Heilongjiang Province of Northeastern China, where in recent 100 years half of the cultivated land suffered from the loss of top soil, i.e. more than 50% of the original soil cover (70-80cm thick) was eroded away.

The eco-environmental issue has become more and more correlative with the whole social-economic activities. And, its consequence is more complicated than the sabotage and pollution caused by single economic exploitation. Today, the basic evaluation to get from Chinese eco-environmental situation is: "suffering from an inherent shortage with acquired imbalance, having not only the ecological deterioration but also serious environmental pollution; and some improvement in partial and local areas, while being steadily worsen for whole country".

ASSESSMENT PROCEDURE

After the foundation of the People's Republic, the government has paid special attention to the improvement of agricultural production conditions, the great efforts having been devoted to farmland capital construction by building irrigation network, improving the soil taming the rivers, afforesting and reserving grassland. But, the excessive exploitation in long-term, the constantly delayed eco-environmental trouble, the ignorance to the necessary preservation of physical environment, as well as some grave mistakes in decision making and policy establishing (such as economic policy, population policy) have made Chinese eco-environmental problems to become a serious obstacle to development. The shortage of resources has already caused a widespread and profound influence and aggravated eco-environmental tension (Table 1).

Table 1 Some resource comparison of China with world average level

	World	China	China/World, %
Farmland, ha/capita	0.28	0.09	32.7
Forest, ha/capita	0.83	0.11	13.2
Grasslands, ha/capita	0.64	0.21	33.1
Timber, m ³ /capita	63.06	9.76	15.5
Run-off of water resources, m ³ /capita	8300	2600	31.3

In order to give out the correct conclusion for evaluating Chinese eco-environmental situation, we have used a general assessment procedure to analyse a regional development. The procedure can be summarized in a flow chart (Fig. 1). A logical conclusion is shown in Fig. 1.

BASIC EVALUATION

Natural hazards

In the past 2200 years, the big flood had happened about 1600 times, the drought about 1300 times in China. Especially, at a same season the flood and drought often happened in

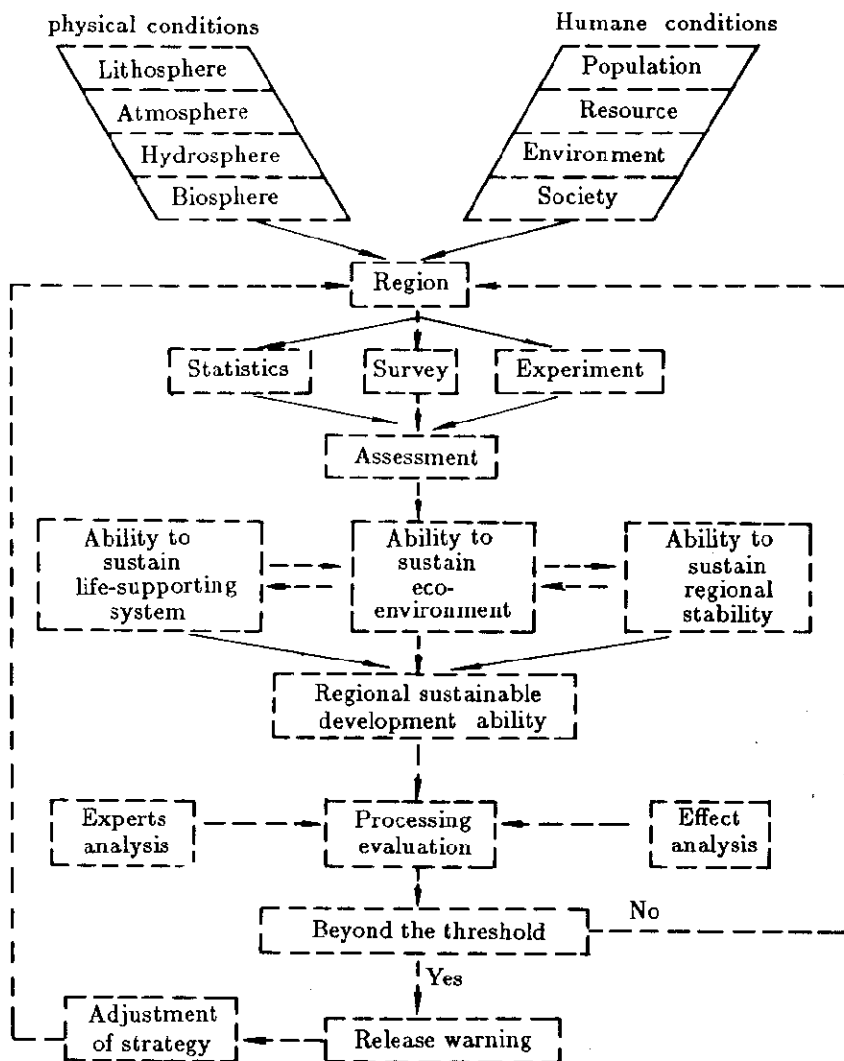


Fig. 1 The flow chart for assessment procedure

different places. An obvious trend is that in the recent years, the disasters are more frequent, and the interval between two disasters becomes shortening. According to our statistics, the average number of emerged natural hazards per year is: Sui Dynasty (1400 years ago), 0.6; Tang Dynasty (1200 years ago), 1.6; Song Dynasty (900 years ago), 2.8; Yuan Dynasty (700 years ago), 3.2; Ming Dynasty (500 years ago), 3.7; and Qing Dynasty (100 years ago), 3.8. The fact of this change obviously relates to human activities. Moreover, Chinese ecological imbalance is also the result of irrational exploitation.

Since 1949, natural hazards in China are still very serious. Table 2 illustrates the area suffered from different kinds disasters from 1952 to 1987.

From the average area suffered from natural hazards in China, 1980s is 1.7-fold as much as 1970s, and 2.1-fold as much as 1950s. From 1979 to 1987, in China, the area of irrigation

field decreased by 0.6 million hectare.

Table 2 The area suffered from different disasters and the grain losses caused

Year	Disaster area, 10 ⁶ hectare	Grain losses, 10 ⁶ tons
1952	4.43	15.40
1957	14.95	56.14
1962	16.67	57.26
1965	11.22	45.95
1970	3.30	16.54
1975	10.24	58.57
1976	11.44	65.55
1977	15.16	86.36
1978	21.30	133.19
1979	15.12	103.29
1980	22.32	147.21
1981	18.74	126.23
1982	16.12	118.84
1983	16.21	131.15
1984	15.26	129.54
1985	22.71	179.68
1986	23.66	167.47
1987	20.39	170.17

Soil erosion

Soil erosion areas are increasing rapidly. Although we have already brought 410000 km² under control since 1949, the total areas of soil erosion grew from 1.16 million km² in 1949 to 1.53 million km² in 1988. Now, the quantity of sediment is about 0.5 billion ton each year, and it takes away 40 million tons of nitrogen, phosphorous and potassium which are equivalent to the annual output of chemical fertilizer in China. The farmland damaged due to soil erosion is one-third of the total arable land. Table 3 shows the areas of different soil erosion intensity.

Forest shrinkage and grasslands degradation

The forest coverage had decreased from 12.7% in 1971-1975 to 12% in 1976-1980, which is far less than world average level (31.3%), ranking China behind 120th in the world. Timber consumption is more than forest's productivity, having the deficit of about 100 million m³ management, the situation of forest is still serious, and annual average forests production is only 2.4 m³ per hectare, which is lower than average world level. Grassland in China is also poor. According to the statistics, the deterioration of Chinese prairie is about 1.3 million hectare every year from 1949-1988. The total area of the deterioration is one third of whole grasslands. The research has shown that grass output of the Chinese prairie in 1980's is only 50% to 70% of that in 1960s. Now, the degradation area of Chinese prairie is still as high as 86.7 million hectare.

Table 3 The area suffered from soil erosion in China

Erosion intensity	Erosion area, km ²	Percentage in total territory, %
No soil erosion	7192330	74.9
Very little erosion	803970	8.4
Put bed load first soil erosion	259680	2.7
Slight erosion	39150	7.2
Moderate erosion	318750	3.3
Substrength erosion	187770	2.0
Strength erosion	75950	0.8
Very strength erosion	61390	0.6
Super strength erosion	10460	0.1
Sum	1553150	16.7
Total	9549450	100.0

Water resources shortage

China has runoff water per capita at one-third of world level. Ranking itself 88th in all countries. The numbers of rivers and lakes are getting less and less. The natural water body in the middle and lower reaches of the Yangtze River has decreased by about 13000 km² since 1954, among which Poyang Lake had decreased by 160000 hectare from 1969 to 1974. The number of lakes on the Jiangnan Plain where is situated in the Yangtze and Han Rivers join, was 1066 in 1950s which the water area of more than 8000 km², but now there are only 326 lakes, with the area reduced to 3000 km². Now, there are 86000 reservoirs in China, but 40% of them are in "ill and danger". In 1979, there were 154 cities in water shortage, but in 1984, more than 188 cities had met the water crisis. Water efficiency for irrigation project is generally 25-40%. The rate of water-reuse for industrial production is about 20-30.

Desertification

The desertificated areas in China increase constantly. They had been enlarged at the rate of 1500 km² per year from 1950s to the late of 1970s. Now, the desert area nationwide is about 1.09 million km², which is 11.4% of the total territory of China. In 1.09 million km², the area influenced by human activities is about 90%. The reasons for desertification are summarized in Table 4.

Table 4 Reasons for desertification in China

Main reasons	Total desertification, %
Overcultivating prairie	25.4
Overgrazing	25.3
Overcutting forest	31.8
Vegetation destroying	9.0
Deflation	5.5

Environmental pollution

The environmental pollution in China has increasingly expanded from urban to rural areas, and present pollution level corresponds to 1950s or 1960s of world developed countries. So, the environmental pollution has already become a very serious problem for economic growth. The pollution has led to large losses and harmed to human health. More than 80% polluted water were discharged into natural water bodies directly without treatment, to allow a large number of volleys being polluted. The amount of sewage was 3.5 billion tons in 1987. It is estimated that there will be 12.9 billion tons in 2000, and 78.4 billion tons in 2020. In China, 42% of cities, the groundwater have critically polluted. From 1983 to 1987, in urban drinking water, COD increased by 280%. BOD increased by 230%, ammonia nitrogen increased by 210%, nitrate nitrogen increased by 220%, and mercury element increased by 100%.

The average level of total suspended particulate in air of nationwide urban areas exceeds national standard; sulphur dioxide exceeds more than one-fourth of national standard in the cities of Northern China. Some places in Southern China (especially Southwestern China) are suffering the harm of serious acid precipitation. The air pollution is mainly caused by coal burning as the "dirty type". Now the output of coal production is over 1 billion tons. Generally, the air pollution in Northern China are more serious than Southern China; middle and small cities and towns are more serious than the large cities; the regions of coal production are more serious than the non-coal regions; winter is more serious than the summer; the morning and evening are more serious than the mid day. At the present, energy resources and coal consumption close by connect with China's GNP and air pollution. The relation between them can be reflected by Table 5.

Table 5 GNP, energy resources, coal consumption and air pollution

Year	GNP index	Energy resources index	Coal consumption index	Air pollution index
1981	100.0	100.0	100.0	100.0
1982	100.5	105.4	107.1	112.0
1983	120.7	111.1	113.4	125.4
1984	138.5	110.3	123.5	137.8
1985	162.1	129.6	135.3	145.4
1986	178.8	137.4	143.8	153.4
1987	203.9	144.6	151.7	159.1

Farmland deduction

Chinese farmland resources have a reductive trend of both the total area and per capita area. Due to the urbanization and economic development, more farmland were used for nonagricultural purposes. Another reason is the increase of the population. According to our analysis, Table 6 gives the dynamic change.

Generally, food, energy and water resource of most areas of China will be in short supply for a long time. Survival, development and fundamental demands of people will make a great

pressure on physical environment, so that the interference to ecological and environmental quality in China will be inevitable.

Table 6 Population and farmland in China

A. D.	Population, 10 ⁶	Farmland, 10 ⁶ ha	Per capita area, ha
2	59.0	21.8	0.93
105	53.2	35.7	0.67
755	80.8	95.3	1.19
976	40.4	17.0	0.42
1072	100.0	44.0	0.44
1393	65.0	24.7	0.38
1600	120.0	33.3	0.28
1774	268.0	65.9	0.25
1850	551.9	80.6	0.20
1960	662.1	104.8	0.16
1970	829.9	101.1	0.12
1980	987.1	99.3	0.10
1986	1045.3	96.7	0.092

BASIC STRATEGY

While speeding up economic growth in China, attention must be paid to the improvement of eco-environmental situation. Therefore, some strategies have been developed to coordinate and promote the improvement of the national eco-systems. They are: to work out "The Plan of Great Land"; to apply widely-spread "Type of Saving Resources" technological systems; to adjust Chinese structure of energy resources; to popularize "ecological consciousness" among the people of the whole country; to promote natural conservation nationwide.

REFERENCES

- Hu Huanyong *et al.*, Population Geography of China, Shanghai: East China Normal University Press, 1986, 51
- National EPA, Statistics of Chinese Environment, Beijing: Environmental Science Press, 1981-1988, 20
- National SB, Yearbook for Chinese Statistics, Beijing: China Statistics Press, 1985, 70
- National SB, Yearbook for Chinese Statistics, Beijing: China Statistics Press, 1987, 240
- National SB, Yearbook for Chinese Statistics, Beijing: China Statistics Press, 1988, 266
- Niu Wenyuan, Applied Geography, Beijing: Science Press, 1987, 111
- Niu Wenyuan, The Principles of Natural Resources, Kaifeng: Henan University Press, 1989, 24
- Xue Muqiao, Economic Yearbook of China, Beijing: Chinese Economic Press, 1981-1988, 510
- Zhao Gan, *et al.*, The history of land scheme of China, Taipei: Taiwan Press, 1985, 66