Discussion on the Relation between Soil and Water Loss and Local Economic Development

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The economic development and social progress have been puzzled and restricted by soil and water loss in China for many years. As a serious problem, soil and water loss is resulted from various factors in the respects of nature, economy, society and science.

Since 1949, we have achieved good ecological and social benefits by making extensive and deep study on how to harness soil and water loss and got a comprehensive way of harnessing mountains, water, forests, fields and roads in the unit of watershed. However, it is short of deep study in the influence of soil and water loss on the economic development, especially on the local economic development. In the view of the human history and nowadays, there is an interactive relation of between economic development and soil and water loss. This paper will make a primary discussion on the relation between the soil and water loss and local economic development.

1 The relation between soil and water loss and various stages of economic development

There is a close relation between soil and water loss and the various stages of local economic development. In fact, economic development is a process of progressively opening up existence space. The different geography locations, resources, economic levels, technology levels usually lead to the different field utilization and ways in the various regions, which will cause different levels of soil and water losses and result in large difference between the regions in the level and speed of economic development and comprehensive strength. And this difference will also the level of the economic development in a region.

1.1 The influence of the initial stages of local economic development on soil and water loss

In the early stage of economic development, the economy develop in an extensive way with more consumption and waste of natural resources, weaker economic force and lower technology level. This kind of economic development is made at cost of consuming natural resources and destroying environment, because it is short of enough economic force to protect water and land resources. Therefore, the irrational application of the land resources usually lead to serious soil and water loss in large scale.

In the early years after the founding of the People's Republic of China, when the national economy had just started, in order to carry out the economic construction in large scale, the limited fund was put into the development and utilization of the natural resources to obtain the primitive accumulation. Although local economy increased in this period, this kind of slow economy increase was at the heavy cost of destroying natural resources and ecological environment. For example, in the years of the "Steel-Smelting Movement", the planted forests and primeval forests were almost felled out in many regions, even the diversiform-leaved poplars in the desert in the Northwest suffered from this misfortune. In the underprivileged areas in the Southwest of China, otherwise, because it is far away from the economic center and short of information exchanging, most of the economic activities are carried out in the traditional forms of slash-and-burn cultivation, extensive cultivation, nomadism and felling. Under the influence of the economic policy of taking grain as the key link, the people felled forests, secondary forests and shrub forests, reclaimed land, and even dug turf and got to the grass roots. Although the government had cleared the importance of the soil conservation after 1949, the predatory development action has not stopped due to the shortage of living environment consciousness and thirsting for the

economic development. On one hand, land reclamation has resulted in grain increase, on the other hand, it has destroyed natural ecological resources and led to serious soil and water loss.

Table 1 GDP IN some years
Unit: 100 million Yuan (RMB)

Year	GDP	Per capita GDP	Primary industry(%)	Secondary industry(%)	Tertiary industry (%)
1952	679	119	50.2	20.9	28.6
1955	910	150	46.3	24.4	29.3
1960	1,457.0	218	23.4	44.5	32.1
1965	1,716.1	240	37.9	35.1	27.0
1970	2,252.7	275	35.2	40.5	24.3
1975	2,997.3	327	32.4	45.7	21.9
1980	4,517.8	460	30.1	48.5	21.4
1985	8,964.4	855	28.4	43.1	28.5

Table 1 shows that the national economy had an obvious increase in the early years after the founding of new China. However, the soil and water loss area also increased from 1.53 million km^2 to 1.79 million km^2 in the end of 1980's, which covers 18.6% of the total land in China. Otherwise, the soil and water loss area of 0.53 million km^2 were harnessed during the 40 years, so that the increased soil and water loss area have reached 0.66 million km^2. Since 1949, according to the statistics, the farmland has been decreased of 3 million ha. by soil and water loss and soil are lost by more than 5 billion ton. Annually. According to the national report of geological survey, the soil and water loss area increase by 7,012.17 ha. in average every year in China.

1.2 The influence of the economic development in medium- and higher-rank stages on soil and water loss

When the economic development get into higher stage, along with the economic development and capital accumulation increasing, the people begin progressively recognizing the importance of the living environment and water and land resources, they have also recognized the effect of ecological environment on human living and economic development. Otherwise, because of science and technology level raising and advanced production technology performing, the economic growth has changed from predatory form to benefit form. Along with the economic development, the people will not only decrease their dependence on the land and have enough economic force to harness soil and water loss, but also strengthen their rational knowledge to protect environment and hope to quicken harness of soil and water loss. Meanwhile, in order to ensure sustainable social-economic development, the people must take measures to protect water and land resources and quicken harness of soil and water loss. All these will produce an active and positive influence on the protection of water and land resources.

Since reform and opening to the outside world, the gap of economic development has been widened between the eastern part and western part of China. All those relate to the difference of soil and water losses in both of the regions to some extent. In the early years of reform and opening to the outside world, the per capita GDP of the 5 provinces in the Northwest China were respectively higher than that of Fujian Province, of which the per capita GDP of Qinghai Province was higher than that of Guangdong Province. By 1999, however, the per capita GDP of Guangdong and Fujian has reached as 1.7—3.5 times as those of the various provinces in the Northwest China (See Table 2).

According to the first investigation by remote sensing in 1980's, there were 21130 km^2 of soil and water loss area in Fujian Province while the second investigation by remote sensing in late 1990's showed that there were 14,830 km^2 of soil and water loss area in Fujian Province, which means that the soil and

Table 2 The Per Capita GDP of some provinces in the East and West China **Unit: Yuan**

Regions	Years	1978	1985	1990	1995	1999
Coastal Areas	Jiangsu Province	430	878	1,300	2,716	4,083
	Zhejiang Province	331	807	1,105	2,566	3,796
	Fujian Province	273	570	839	1,909	2,839
	Shandong Province	316	617	848	1,763	2,617
	Guangdong Province	367	741	1,269	2,779	3,827
Northwest China	Shanxi Province	294	505	718	1,081	1,466
	Gansu Province	348	519	757	1,097	1,486
	Qinghai Province	428	626	737	991	1,301
	Nei Mongol Autonomous Region	317	626	822	1,227	1,741
	Ningxia Autonomous Region	370	623	807	1,087	1,432
	The Whole Country	379	665	899	1,493	1,977

water loss area had a net decrease by 7,000 km^2 (including the increased soil and water loss area and the harnessed soil and water loss area). And the second investigation showed that the soil and water loss area had decreased from 50.373 km^2 in the first investigation to 32.432 km^2 in Shandong Province, which means that the soil and water loss area had a net decrease by 17,941 km^2. During the 10 years, however, the soil and water loss area in the provinces of Gansu and Qinghai have respectively from 106937 km^2 and 40,060 km^2 to 119,370 km^2 to 53,137 km^2 (See Table 3).

Table 3 Investigation of soil and water loss situations in various provinces **Area unit: km^2**

Provinces	Area of soil corrosion in 2000（S）	Area of soil corrosion in 1990（F）	Comparison （S－F）
Zhejiang	18,323	25,708	–7,385
Heilongjiang	86,539	112,560	–26,021
Fujian	14,832	21,130	–6,298
Sichuan (Chongqing)	202,440	184,154	18,286
Gansu	119,370	106,937	12,433
Qinghai	53,137	40,060	13,077
The whole country	1,648,816	1,794,169	–145,353

Data source: Statistics from the concerned departments.

Table 4 Comparison between the GDP and soil and water loss situation in the 6 provinces in the Eastern and Western parts of China

	GDP（100 million Yuan）			Soil and water loss situation（km^2）		
	1990	2000	Variable（Times）	1990	2000	Variable(%)
Fujian	465.84	3,920.07	7.4	21,130	14,832	–29.8
Liaoning	964.89	4,669.06	3.8	63,715	48,221	–24.3
Guangdong	1,471.84	9,662.23	5.6	11,381	11,010	–3.26
Sichuan	1,146.63	4,010.25	2.5	184,154	202,440	9.93
Gansu	234.39	983.36	3.2	106,937	119,370	11.6
Nei Mongol	286.62	1,401.01	3.8	158,101	150,219	–4.9

Data source: National Yearbook of Statistics of China.

Table 4 clearly shows: There are soil and water loss situations in the various stages of economic development; The different conditions of the economic development in the same period will also cause different soil and water losses.

In the period of the 7th "Five-Year Plan", the government divided the country into 3 economy zones of eastern part, middle part and western part according to the levels of economic and technology development as well as the geography locations. It is shown that there is a close relation between the economic development and soil and water loss in the 3 zones.

In the view of the economic development in China, the western part is the region with the lowest ability to develop economy. Since reform and opening to the outside world, the proportion of GDP of this region in the whole country has continuously decreased. From 1978 to August of 1990, GDP increased by 11% in the whole country while 10% in the western part, 11% in the middle part and 14% in the eastern part. In general, GDP of the western part was lower 4% and 1% than those of eastern and middle parts. As for the proportion of GDP in the whole country, the proportion of GDP of the western part in the whole country has a decreasing tendency year by year. From 1990 to 1995, the proportion of GDP of the western part in the whole country decreased by 0.6% annually. In 1996, 1997 and 1998, the proportion of GDP was 13.6%, 13.5% and 13.4% of that in the whole country. In 1999, it was 13.3%. Although the average decreasing speed has slowed down from 0.6% to 0.1%, the decreasing tendency is not changing.

As for the soil and water loss situations in the whole country (See Table 5), the soil and water loss area has reached 64.81% of the total in the whole country.

Table 5 The soil and water loss situations in China **Unit: 10,000 km^2**

Regions		1990		2000	
		Quantity	%	Quantity	%
Eastern part		19.6480	11.91	25.4131	14.17
Middle part		38.3888	23.28	49.9289	27.83
Western part	Northwest	57.7154	64.81	56.2243	58.0
	Southwest	49.1294		47.8506	
In the whole Country		164.8816	100	179.4169	100

Therefore, in order to ensure sustainable local economic development, allow bring benefit to human being, we must fully recognize the relationship between the local economic development and water and land resources protecting and exploiting, correctly deal with and coordinate the relation between water and land resources protecting and local economic development, especially in the depressed areas. As for the developing areas, the greatest challenge in ecological environment is the destroying and worsening of resources and ecological conditions, which is not only one of the important obstacles to restrict the economic development in the western part, but will also influence the development in the whole country. The frailness and worsening of the ecological conditions will influence the economic growth in the initial stage of development as a basic factor to influence human living, especially in the economic developing areas.

2 Influence of the three industrial structures on soil and water loss

2.1 Three Industrial Structures and Soil and water loss

The economy is established on foundation of certain industrial structures in any region. In the various period, the local economy have different characteristics of industrial structures. The different industrial structures have different influences on the application, exploitation and protection of land to some extent.

Since reform and opening to the outside world, the industrial structure has clearly changed in China,

which have positive influence to the local economic development and soil conservation. According to the proportion in GDP, the proportion of primary industry in GDP has decreased from 28.1% in 1978 to15.89 % in 2000, which means it has decreased by 12.21% in total.

Table 6 GDP in the whole country and industrial structures

Year	GDP （100 million Yuan）	Per capita GDP（Yuan）	Industrial structures(%)		
			Primary industry	Secondary industry	Tertiary industry
1985	8,964.4	855	28.4	43.1	28.5
1990	18,547.9	1,634	27.1	41.6	31.3
1995	58,478.1	4,854	20.5	48.8	30.7
2000	89,403.6	7,078	15.9	50.9	33.2

Table 7 GDP in 1995 and industrial structures

Region	GDP（100 million Yuan）	Per capita GDP（Yuan）	Industrial structures(%)		
			Primary industry	Secondary industry	Tertiary industry
In the whole country	58,261	4,754	20.5	48.4	31.3
Eastern part	33,615	6,780	16.5	51.5	32.0
Middle part	15,868	3,691	25.5	44.3	30.0
Western part	8,150	2,945	28.0	38.8	33.2
Proportion of eastern, middle and western parts	4.12:1.95:1	2.30:1.25:1	0.59:0.91:1	1.33:1.14:1	0.96:0.91:1

Data source: National Yearbook of Statistics of China.

Table 8 GDP in 2000 and industrial structures

Region	GDP (100 million Yuan)	Per capita GDP (Yuan)	Industrial structures(%)		
			Primary industry	Secondary industry	Tertiary industry
In the whole country	89,403.6	7078	15.89	50.88	33.2
Eastern part	55,689.58		11.79	48.78	39.25
Middle part	24,865.17		19.4	45.94	34.66
Western part	16,654.62		21.16	42.7	36.14
Proportion of eastern, middle and western parts	3.34:1.49:1		0.56:0.91:1	1.14:1.08:1	1.09:0.95:1

Data source: National Yearbook of Statistics of China in 2000.

Table 6 and Table 8 shows that the industrial structures have a more rational, coordinated and suitable development to the market economy along with the social and economic development and the proportion of the three industries. Readjusting of the industrial structures have lightened reclamation pressure, which will decrease soil and water loss to some extent. Both of the investigations of the soil and water loss situations made in China in the late 1980's and late 1990's show that the soil and water loss area have comparatively decreased by 0.145 million km^2, which means that readjusting of the industrial structures and the decreased proportion of the primary industry have offered a positive

influence on the soil conservation.

Meanwhile, we also get to know that the proportion of agriculture is less than 20% and the proportion of secondary and tertiary industries have got to about 80% in the eastern part while the proportion of agriculture is more than 70% and the proportion of secondary and tertiary industries is less than 30% in western part. Slow development of the township enterprises in the western part has led to the local economic development seriously delaying, which have further added to the burden on the land resources in the area.

2.2 Agriculture structure and soil and water loss

As for the influence of industrial structure on the soil and water loss, the agriculture have more direct and important influence on the soil and water loss. During the 30 years from 1949 to reform and opening to the outside world, under the influence of the traditional agriculture structure and the concerned agriculture policy, the agriculture production was not carried out with its own characteristics in the various areas. For a long period, the development strategy of "taking grain as the key link" did not only result in so large proportion of plantation in the primary industry, but also made the agriculture structures similar with each other in various areas (See Table 9). Especially in the western part of China, there are a large part of the land suitable to the development of forestry and animal husbandry, but their proportion in agriculture is even lower than those in the middle and eastern parts while the proportion of plantation is higher. All these have resulted in destroying forests to open up wasteland, planting on the slope land and too large farmland. Therefore, the agriculture production has not only fell into the vicious circle of "more poor more reclaiming, and more reclaiming more poor", but also destroyed forests and vegetation, and aggravated soil and water loss. Only in the areas of the Loess Plateau, so large area of farmland have caused soil and water loss in great quantity. Annually, there are 40%—60% of the sand flowing into the Yellow River are from the slope farmland. The concerned experiment shows that the sediment yield from slope farmland is as 5 times as that from natural slope wasteland, 50 times as that from grassplot, 66 times as that from shrubbery, and 100 times as that from high forests.

Table 9 The structures of farming, forestry and animal Husbandry in the Eastern, middle and Western parts of China (1998)

Region	Planation GDP (100 million Yuan)	Proportion (%)	Forestry GDP (100 million Yuan)	Proportion (%)	Animal Husbandry GDP (100 million Yuan)	Proportion (%)
Eastern part	6,404.32	65.0	392.97	4.0	3,056.71	31.0
Middle part	5,014.68	62.9	301.83	3.8	2,654.49	33.3
Western part	2,822.90	66.1	156.50	3.7	1,289.50	30.2
Whole country	14,241.9	64.5	851.30	3.9	7,000.7	31.6

Data source: National Yearbook of Statistics of China in 1999.

Table 10 Outputs of farming and township industry in various areas (1995)

	Eastern Part	Middle Part	Western Part
Gross output of farming (100 million Yuan)	9,982.23	6,785.30	3,573.33
Per capita output of farming(Yuan)	2,683.90	2,107.20	1,614.60
Gross output of township industry(100 million Yuan)	36,219.10	11,126.97	3,913.10
Per capita output of township industry (Yuan)	10,544.90	3,455.40	1,768.10
Ratio between gross output of township industry and gross output of farming	3.63:1.00	1.64:1.00	1.10:1.00

The difference of the agriculture structures between the eastern part and western part of China have led to the difference of local agriculture development and the difference of incomes of the countrymen. The countrymen in the eastern part get their incomes of 70%—80% from the township enterprises while the countrymen in the middle and western part get their incomes of 70%—80% from farming of lower efficiency. There is a worsened natural ecological environment in the western part of China. In the northwestern part, it is drought and short of rainfall and water resources. In the southwestern part, although it is rich of rainfall, karst topography and bare-stone mountains cover a large proportion and the forests have been seriously destroyed in the area. In the whole western part, the slope farmland of more than 25^{o} has covered 1/4 of the total in the mountain areas. In addition, the cultivating technology is backward with shortage of science and technology knowledge of farming. All these have a serious negative influence on agriculture production and local economic development and have resulted in man made soil and water loss in large quantity. Therefore, in order to quicken the economic development and raise the income of the country men in the western part, water and land resources must been exploited in a scientific way. On the premise of strengthening agriculture as a foundation, it must do as to readjust the agriculture structure according to the local conditions, develop the agriculture of higher efficiency, develop the sustainable township enterprises and other industries, especially to speed the development of township industry.

Sum up, the different industrial structures will lead to difference in application of the land and depending on the land. The lower the industry level is, the more serious the soil and water loss is. Along with industrial structure optimizing, the dependence on the land will be weakened and the land application will be made in a scientific and rational way. Therefore, it will show a weakening and slowing tendency in the water and land resources application and influence.

3 Work-Division of Local Economy and Soil and water loss

In the condition that the world economy has progressively got into globalization and integration, any country and region will carry out the local economic activities according to their comparative superiority, so as to bring their own superiority into full play and improve the local economic development. The difference in the work-division of local economy will not only influence the local economic development in scale, speed and form, but also influence the local soil and water loss.

When the work-division of economy belongs to production of primary products and raw and processed materials in a region, the local economic development depends on exploitation, application and processing of the natural resources, during which the soil and water loss should be sharpened. The reason to sharpen soil and water loss in this period is that, on one hand, it is necessary to enhance the reclamation of land, on the other hand, production of primary products and raw and processed materials as well as exploiting mines highly depend on land. Otherwise, when a region has its production get into the stage of producing higher-level products and finish machining of primary products, the dependence on land will be greatly decreased, so that soil and water loss will be decreased and ecological environment will be protected.

At present, most of the developing countries are in the stage of production of the raw and processed materials according to the local work-division. Therefore, they have a slow economic development and serious soil and water loss in a bad ecological environment. The western part of China is also in this kind of the stage, which is the reason that the soil and water loss is more serious in the western part than that in the developed areas in the eastern part.

The above-mentioned macro-analyzing and simple data analysis show that the soil and water loss extent has a high relationship with the economic development in a region. In the early period of economic development, the local industry is structured in mainly primary and secondary industries, which has a great dependence on the land and has an extensive application of land. In this period, because of the restriction of economic development and the limit rational knowledge, the people can not effectively use and protect the land in a scientific way, which have a negative influence on the water and land resources and result in serious soil and water loss.

When the economic development in a region get into the higher stage, the local industry is structured mainly in secondary and tertiary industries, which will have a greatly decreased dependence on land. In

this period, because of higher level of economic and science development and enough rational knowledge, the people will effectively use and protect the land in a scientific way, which will restrict soil and water loss. In this sense, in order to decrease local soil and water loss and effectively protect water and land resources, we must speed up the local economic development, readjust and optimize the industrial structure, so as to make the local economy in scientific and favorable work-division.