

FACTORS BEHIND SOIL EROSION AND THE IMPACT OF SOIL EROSION ON SOCIOECONOMIC DEVELOPMENT

Soil erosion can be caused by many factors, including natural factors and man-made factors. Studies on soil erosion in the upper reaches of the Yangtze River suggest that water and soil losses in the region basically fall into the category of man-made accelerative erosion. Therefore, man-made factors behind soil erosion will be examined in the following passages.

Rapid Population Growth and Scarcity of Skilled Human Resources

Rapid population growth in the area has direct influence on soil erosion in the region. The total population in the region amounts to 146 million, having doubled in the period dating from the establishment of the People's Republic of China in 1949. The average population density in the region is 146/km². Because of the extensive mountainous areas, the basins, plains, hills, and low mountain areas are densely populated. For example, in the Sichuan Basin the population density ranges from 700 persons/km² to 800 persons/km², although on average the above-mentioned areas have 400-500 persons/km² (Chengdu Institute of Mountain Disasters and Environment 1988). Some detailed population indicators can be seen in Table 3.1. The literacy rate is very low because the population has little access to education. This has an adverse effect on farming skills and hence there are a number of problems related to the land use system in the region. Some of these problems will be described in the following passages.

1. In some mountain areas that are mainly settled by minorities, slash and burn agriculture is locally still practised, destroying or degrading the natural resources (Commission Office for Soil-Water Conservation 1990). The productivity of farmland in the region is low, and unit outputs of major crops are lower than the average in China as a whole. For example, Table 5.1 shows the unit outputs of major crops in southwestern China, including the Sichuan and Guizhou provinces (Chang Hong 1990).

In the mountains and hills of the region, the farming system is very simple, crops and livestock being the only components. The agrarian population constitutes the majority of the total population. For example, in Bijie District, in the upper reaches of the Wu, the agrarian population accounts for 95 per cent of the total population. In some counties, the proportion is 98 per cent, resulting in the unsustainability of mountain agriculture.

Table 5.1: Unit Outputs of Major Crops in Southwestern China

(based on 1986 data)

Item	Sown Areas (10 ⁴ ha)	Total Output (10 ⁴ kg)	Unit Output (kg/ha)	Compared With				
				China	Hubei	Hunan	Jiangsu	Shandong
Rice	741.65	377.1	5084.55	5340.00	6390.00	5700.00	7035.00	5910.00
Wheat	269.77	72.7	2695.75	3045.00	2925.00	1680.00	4140.00	3705.00
Maize	365.14	112.1	3070.05	3705.00	3030.00	2010.00	5010.00	4425.00
Potatoes	228.47	64.8	2610.00	2925.00	2865.00	2625.00	4830.00	5190.00

* Hubei Province and Hunan Province are located in the middle reaches of the Yangtze River; Jiangsu Province is located in the lower reaches of the Yangtze River.

Source: Cheng Hun 1990

2. Unreasonable land use structure and steep sloping cultivation in mountainous areas leads to unfeasible land use. The Qlong Basin, a tributary of the Fu, covers 4,329.2 sq.km. of agricultural land which is 57.7 per cent of the total area; forest land covers 9.4 per cent, transportation networks 8.9 per cent, and grassland only 0.9 per cent. In the Basin, low per capita forest coverage with less pasture land leads to serious soil erosion. In most mountainous areas, clearing of forests for agricultural production is the principal method used to meet the needs of the rapidly growing population. In Guizhou Province, the plains cover only three per cent of the total area and steep sloping land has to be cultivated as farmland. Farmlands on slopes of $> 25^\circ$ account for 25 per cent of total dry land in the province and some farmlands are even on slopes of $> 35^\circ$. Some farmlands have been taken from deforested areas. In Bijie District of Guizhou Province, the population has doubled in three decades and the farmland area has increased from 0.43 million ha to 0.59 million ha (1980). Forest coverage declined from 17 per cent in 1957 to 5.8 per cent in 1975, and this decline has continued until the present. Table 5.2 lists population density, land available per capita, forest coverage, and water and soil losses in some selected counties of the central hills of the Sichuan Basin. From the table it can be understood that rapid population growth causes land scarcity, deforestation, and severe water and soil losses (Sichuan Bureau of Forestry 1988).

Deforestation

The forests in Western Sichuan and Western Yunnan contain China's second largest store of forest biomass. A rich variety of broad-leaved evergreens are prevalent in natural stands and their felling age is usually less than 30 years. In Sichuan Province, the forest coverage has declined from 19 per cent in the early 50s to about 13.3 per cent today and in Yunnan Province, from 28.4 per cent to 24 per cent. At present, in Guizhou Province, the forest coverage is only 12.6 per cent. In many places, the forests have completely vanished and in eastern Sichuan's 53 counties, 50 per cent of the counties have less than three per cent of forest coverage. The forest coverage in 20 counties in the Central Sichuan Basin is less than one per cent and, in western Guizhou Province, less than 10 per cent (for example, Bijie District, 5.6%; Liupanshui less than 5%; and in Yuanmou, Dongshuan, and Lijiang of Yunnan Province, forest coverage is only 5-6%).

Deforestation in the region is caused by many factors, some of which are summarised below.

- a. All forests throughout China were subjected to severe damage owing to the large-scale iron-smelting campaign started in 1958, the so-called "Great Leap Forward". Much of the accessible timber around tens of thousands of villages and towns was cut to provide charcoal for primitive "backyard" furnaces producing useless pig iron. In less than ten years, the "Cultural Revolution" started and the general lawlessness of its first few years resulted in the destruction of natural resources, including forests, for short-term gains. By far the most important reason for accelerated deforestation in the late 60s and during most of the 1970s was another policy - "taking grain as the key link", the Policy Research Office of the Ministry of Forests states that the reclamation of forests for green fields and forest fires have destroyed at least 6.7 million ha since 1949.
- b. Overlogging to fulfil high timber production quota and provide financial revenue. Illegal cutting, slash and burn agricultural practices in some minority settlements, poor management of forest regeneration and plantation, and forest fires are also responsible for deforestation in the region.

In the high mountains and deep valleys of the region, forest areas cover 8.667 million sq.km., forest coverage being 21.9 per cent and stand storage 1.35 billion cubic metres, accounting for five per cent of the total forest storage in the Yangtze Basin. Since the founding of the PDRC, more than 20 forestry enterprises have been established in succession in this area, and the total annual felling of timber amounts to from 15 million-20 million cubic metres. However, because most of the forests in this area are mature and/or overmature, the total annual increment is only 6 million - 7 million cubic metres,

therefore, the annual net loss is 8 million to 13 million cubic metres. In addition, regeneration is difficult and the population scarce in Western Sichuan where the forest coverage has decreased to 9.9 per cent. In Western Yunnan It has decreased to 16 per cent and large areas of forested land have become brushwood land. Local governments in some mountainous counties fell beyond the state-set quota. For example, a county-run forestry enterprise with 206 employees in Mull County fells 0.12 million cubic metres of timber annually.

Table 5.2: Population Density, Land Available Per Capita, Forest Coverage, and Soil Erosion in the Central Hills of the Sichuan Basin

Item County	Population Density (person/ km ²)	Per Capita Land (ha)	Per Capita Land for Affore- station (ha)	Per Capita Forested Land (ha)	Per Capita Barren Land (ha)	Forest Coverage (%)	Soil Erosion Intensity	Soil Erosion- Affected Area (% against total area)
Suining	616	0.160	0.003	0.001	0.002	0.5	extra heavy	79.8
Shehong	609	0.153	0.153	0.012	0.002	7.8	heavy	
Shong- jiang	605	0.173	0.011	0.004	0.003	2.7	heavy medium	
Pengxi	563	0.180	0.002	0.001	0.001	0.8	extra heavy - heavy	79.8
Anyue	508	0.200	0.009	0.002	0.003	1.0	heavy - medium	71.4
Santai	596	0.193	0.059	0.007	0.23	3.5	heavy - medium	
Tong- liang	559	0.153	0.015	0.009	0.003	5.9	extra heavy - heavy	72.5
Yong- chuan	629	0.153	0.017	0.008	0.003	5.4	medium	
Long- chang	857	0.120	0.003	0.003	0.001	2.2	heavy - medium	
Rong- chang	831	0.140	0.004	0.001	0.001	1.1	medium - light	
Dazu	611	0.173	0.009	0.005	0.003	2.7	extra heavy	77.4
Ziyang	566	0.173	0.007	0.001	0.003	1.1	heavy - medium	
Wusheng	704	0.140	0.001	0.0001	0.0003	0.1	heavy - medium	
Quxian	598	0.160	0.29	0.001	0.008	11.7	medium	

Source: Sichuan Bureau of Forestry 1988

In the densely populated foothills, communities consume large amounts of wood for indoor heating, cooking, house construction and maintenance, and some for items of farm water projects. Some investigations point out that in areas where energy is in short supply, each farmer needs 2,000 to 2,500 kg of firewood annually to meet energy needs. In mountain valleys, each household needs 5,000 kg of firewood per annum. A large amount of firewood is obtained from illegal cutting. Table 5.3 lists the firewood deficit months in some selected counties in the Sichuan Basin, indicating a heavy impact on the forests in this area.

Table 5.3: Population Density and Firewood Deficit in Some Selected Counties

Item County	Suining	Shehong	Zhongjiang	Anyue	Santai	Tongliang	Yongchuan	Longchang	Rongchang	Dazu
Average Firewood Deficit (month/household)	3	3	6	3	2.7	11	4	2	8	11
Population Density (person/km ²)	616	609	605	508	596	559	627	857	831	611

Source: Sichuan Bureau of Forestry 1988

Some surveys also point out that in Southern China (including the Sichuan, Guizhou and Yunnan provinces), the forest storage consumed as firewood annually accounts for 35-40 per cent of the total timber consumption, and, in some forest districts, even up to 60 per cent. A new development in firewood consumption in the region should be mentioned. In recent years the valley and township enterprises have mushroomed into rural areas resulting in rapid and vast increments in firewood consumption. For example, cured tobacco production, tea finishing, brick and tile production, and lime production are mainly dependent upon firewood as fuel. In the Aba, Ganzi, and Liangsheng minority autonomous districts of Sichuan Province, the forest coverage has declined from more than 40 per cent in the 1950s to 14 per cent at the end of the 1970s, mainly because of slash and burn agriculture. It has been projected that the existing forest storage in Aba District could be exhausted in 13 years, based on the actual amount of timber felled in 1984.

Deforestation in the region is closely related to soil erosion - the soil erosion affected area is increasing in Guizhou Province. In 1964 it totalled 0.035 million sq.km.; but it had risen to 0.05 million sq.km., an increase of 42.9 per cent in 20 plus years. In Sichuan Province, the soil erosion affected area in the 1950s was 0.0946 million sq.km. and it is now approaching 0.0369 million sq.km., accounting for two-thirds of the total provincial area.

The strong linkage between deforestation and soil erosion in the mountains can be seen in Table 5.4 (He Ying Wu 1988).

Table 5.4: Soil Erosion in Selected Districts of the Jinshan Basin

Item/District	Diqing	Lijiang	Shaotong	Dongchuan
Precipitation (mm/a)	787	975	939	689
Area of slope > 25° (% against total area)	62.14	45.2	45.8	61.50
Forest coverage (%)	36.8	30.3	6.6	4.8
Soil erosion - affected area (% against total area)	19.05	23.33	58.93	53.55
Soil erosion area with medium intensity (% against total soil erosion area)	6.45	4.01	33.97	53.55

Source: He Ying Wu 1988

The same conclusions can also be drawn from the data on relationship between forest coverage and soil erosion which are listed in Tables 5.5 and 5.6.

Table 5.5: Forest Coverage and Soil Erosion in Bijie District in the Wu Basin

Item	Year	Erosion Area		Total Amount of Soil Loss (10 ⁴ T)	Erosion Modulus (T/sq.km. annum)	Forest Coverage (%)
		Area (10 ⁴ ha)	% of Total Area			
	1982	109.2	40.6	3166.63	2900	17.5
	1986	140.9	52.2	6945.6	4927	14.9

Source: Chengdu Institute of Mountain Disasters and Environment 1990

Table 5.6: Forest Coverage and Soil Erosion in Selected Counties in the Upper Reaches of the Wu Basin (based on 1988 data)

Item	County	Forest Coverage (%)	Annual Soil Loss (10 ⁴ T)	Erosion Modulus (T/sq.km annum)
	Zhujin	3.5	909.2	6745
	Neyong	3.6	820.0	6348
	Jinsha	7.1	67.6	807
	Weining	10.4	25.0	185

Source : Chengdu Institute of Mountain Disasters and Environment 1990

Unreasonable Use of Sloping Agricultural Land

Some aspects of land resource and land use in the upper reaches of the Yangtze have been mentioned. Two tendencies in land resource and land use should be pointed out.

- a) Land resource and land use have certain characteristics that are attributable to the mountainous nature of the area; for example, 38 per cent of all farmland is in the plains, 42 per cent in the hills, and 20 per cent in the mountains. Table 5.7 lists the breakdown of farmland into morphological types in Sichuan Province.

Table 5.7: The Breakdown of Farmland into Morphological Types in Sichuan Province

Item/ Morphological Type	Reclamation and Cultivation Index	Percentage of Farmland against Total Land (%)	Percentage of Paddy land against Total Farmland (%)
Plains	> 60 %	15.4	> 80 %
Hills	Approx. 40%	62.5	Approx. 40%
Mountains	5 - 10%	20.7	Approx. 20%
Plateaux	< 1%	1.4	0.0

Source: Zhenglin et al. 1980.

From Table 5.7 it can be seen that, in Sichuan Province, farmland in the hills and mountains accounts for 83.2 per cent of the total farming area. Some data obtained in Southwestern China proved helpful because Southwestern China includes the Sichuan, Yunnan, Guizhou, and Guangxi provinces. Most of Sichuan, Yunnan, and Guizhou provinces fall in the upper reaches of the Yangtze River. In southwestern China, the mountain area covers 0.067 million sq.km., accounting for 50 per cent of the total area of the region. The mountain population accounts for 44.4 per cent of the regional total and the agricultural population accounts for 89.3 per cent of the regional total, indicating the important position of mountain agriculture in the regional economy.

Hilly and mountainous farmlands are subject to soil erosion. The data point out that annual soil erosion loss on sloping farmland of $> 5^\circ$ is 714 T/sq.km.; 9,260 T/sq.km. on sloping farmland of $> 15^\circ$; 15,137 T/sq.km. on sloping farmland of $> 20^\circ$ and 21334 T/sq.km. on sloping farmland of $> 25^\circ$.

- b) The average area of farmland per capita available for the agrarian population is declining in the region because of rapid population growth and capital construction.

In Southwestern China, the farmland available per capita is 0.0978 ha; 71.53 per cent of the average throughout China. It has been projected that in 2000 A.D. the farmland available per capita will be 0.08 ha in Sichuan Province. The farmland available per capita for the agrarian population has declined from 0.13 ha in 1949 to 0.08 ha in recent years.

- c) Marginal land reclamation and cultivation is the only way to meet the food demands of the rapidly growing population in mountainous areas. In the western part of Sichuan Province, which covers part of the Hunduen Mountains, nine counties in southwestern Aba District, eight counties in southwestern Ganzi District, Muli County in Xichang District, and Baoxing County in Yunnan District, most of the farmlands are on slopes. According to field data, farmlands on slopes of $< 10^\circ$ account for 10 per cent of the total sloping farmland, $10-20^\circ$ sloping farmland - 23 per cent, $20-25^\circ$ sloping farmland - 20 per cent, $25-35^\circ$ sloping farmland - 20 per cent, and 21 per cent of sloping farmlands are on slopes of $> 35^\circ$. Steep sloping cultivation is the main factor behind soil erosion.

In this region, areas lightly affected by soil erosion account for 25 per cent of the total farmland, areas affected by medium soil erosion 35 per cent, and areas affected heavily by soil erosion 40 per cent. In southwestern Sichuan Province, in a total area of 31,000 sq.km., farmlands cover 21,93,333 ha, accounting for seven per cent of the total land area, of which most is dry farmland on slopes. For example, in Liangshan District, 30 per cent of the farmland is on slopes of < 25°, and, in Mabain and Shimian counties, 30 per cent of the farmland is on slopes ranging from 45-50°. Farmland on steep slopes is called "hanged land" by the local people. Because of the degree of soil erosion, the unit output of farmland is very low.

Apart from the factors mentioned above, mountain infrastructure without proper measures to preserve the soil from erosion could also trigger or accelerate soil erosion. Unfortunately data on this are not available.

Impact of Soil Erosion on Socioeconomic Development

Soil erosion is not only a symbol of the degradation of the mountain ecosystem, it also constitutes a serious negative impact on environmental conditions and socioeconomic development in mountain areas and in the lowlands.

Soil erosion could cause a loss of soil fertility and productivity. Topsoil is often made thinner by soil erosion. According to data on the Three Gorges' Dam District, land with 10-25cm of soil depth accounts for 52.1 per cent of the total land area and 36.5 per cent of the soil has a soil depth ranging from 25cm to 50cm. In the Qiong Basin, 40 per cent of the total sloping farmland has a soil depth of less than 30cm. In Bijie District, Guizhou Province, farmland with topsoil of less than 15cm accounts for 49.3 per cent of total farmland in the district (Commission Office for Soil-Water Conservation 1990).

Farmland with thin topsoil has low productivity, for instance in Suining, Tongling, the unit output of farmlands with 15-18cm soil depth is only 40 percent - 70 per cent of the average unit output (Chengdu Institute of Mountain Disasters and Environment 1988).

Soil fertility will be lost by soil erosion, and, in this case, large amounts of fertilizer have to be applied to maintain farmland productivity. In Sichuan province, 270 million tonnes of fertile topsoil are washed away each year, fertilizer application has increased 87.7 times from 69,000 tonnes in 1957 to 6,052 million tonnes in terms of an application level per hectare of from nine kg to 925.5 kg (Commission Office for Soil-Water Conservation 1988). In Bijie County, 37.4 per cent of farmland is deficient in organic matter and in nitrogen, 90.1 per cent of farmland is deficient in phosphorous, and 27.1 per cent is deficient in potassium (Chengdu Institute of Mountain Disasters and Environment 1990).

Table 5.8 gives the erosion loss on sloping farmland in the Wu Basin.

Table 5.8: Erosion Loss on Sloping Farmland in the Wu Basin

Reaches	Farmland area (sq.km.)	Total erosion loss (10 ⁴ Tonne)	Erosion Loss							
			8 - 15°		15° - 25°		25° - 35°		> 35°	
			loss	% of total	loss	% of total	loss	% of total	loss	% of total
Upper	9016.75	4474.86		19.56	1758.27	39.12	820.52	18.25	1036.93	23.07
Middle	8723.25	2889.57	686.95	23.77	1134.02	39.25	567.02	119.62	501.58	17.36
Lower	5558.22	2294.16	229.28	9.99	1083.86	47.24	469.66	20.48	511.36	22.29

Source : Chengdu Institute of Mountain Disasters and Environment 1990

Damage to Rivers, Lakes, and Water Conservation Projects

The increment of sediment concentration in the rivers is closely related to soil erosion in the river basin. The areas affected by soil erosion in the Yangtze River Basin are increasing at a rate of 1.4 per cent per annum. The areas with an erosion modulus of $< 1000 \text{ T/sq.km.}$ cover Yuanmou, Dongchuan, and Shaotong in Yunnan Province, the upper reaches of the Jialing River, the border areas of the Sichuan Basin, the lower reaches of the Yalong River, the Min River, and the Dadu River, covering 15 per cent of the total area of the upper reaches of the Yangtze. The annual average sediment discharge totals 63.6 per cent of the total sediment discharged in the upper reaches of the Yangtze.

In the upper reaches of the Yangtze, most of the sediment is from the Jinsha and Jialing rivers. The average sediment discharged from each river accounts for 45.8 per cent and 27 per cent of the total sediment discharged from the Yangtze River above Yichang respectively. According to data recorded in a number of hydrometric stations, the sediment concentration of the Longshuan River is rising, e.g., it was $4,015 \text{ kg/m}^3$ in the 1960s, $5,348 \text{ kg/m}^3$ in the 1970s, and $8,427 \text{ kg/m}^3$ in the 1980s. The sediment discharged from the Xiao (data from Dongchuan) has increased with time; e.g., from 4.88 million tonnes per annum in 1960, 11.10 million tonnes per annum in 1966, and to 30.00 million tonnes per annum in 1986.

The off-farm economic losses caused by soil erosion are outlined in the following passages (Fang Zheng San 1987).

Aggravation of Flood Damage

Much of the sediment caused by soil erosion silts up the river beds and reduces the discharging capacity of the rivers. For example, the river bed of the lower reaches of the Yellow River increases 10cm each year because of silt. As a result, the river bed is three to five metres higher above ground level on average and in some sections, more than 10m. Therefore, the Yellow River is called the "suspended" river. Similar situations can be found in the Upper Reaches of the Yangtze and the Xi, which is a tributary of the Jialing River (its bed has increased by two metres from the 1950s to the 1970s). The river beds of the six tributaries of the Jialing River in Guangyuan County are 0.8-3.5m higher than they were in the 1950s and one section of the Yangmu River bed is 1.5m higher than the surrounding farmland. One of China's worst floods for decades was certainly aggravated by widespread deforestation, soil erosion, and silting of the river bed. The Yangtze flood in Sichuan Province in mid-July of 1981, the worst inundation since 1877, directly effected 119 counties and cities inhabited by 15.84 million people, out of which 888 people were killed and 13,010 people injured. It flooded 1.39 million dwellings, 26,000 factories, and 830,000 ha of mostly fertile, level farmland (destroying or badly damaging a potential harvest of some 1.5 million tonnes of grain) and caused damage to 38,000 water conservation works. Direct monetary losses were estimated at 2.5 billion. A consensus on "painful lessons" quickly emerged. Besides the uncontrollable natural factors - heavy rainstorms, during which more than 100mm of rainfall were recorded at 17 weather stations in 24 hours - the loss of 30 per cent of the province's forested land by blind conversion of slope land into grain fields causing soil erosion and silting of the river beds and improper construction of water conservation projects were clearly to blame.

The frequency of floods has also increased during recent years. Table 5.9 lists the frequency of floods in Sichuan Province.

Table 5.9: The Frequency of Floods in Sichuan Province

Period	1950-1960	1961-1970	1971-1980	1981-1986
Bad floods (Nos.)	3	5	6	6

Source: Chenghong and Zhangmintao 1990

Damage to River Navigation

The silting of river beds reduces the number and size of navigable passes. The mainstream and tributaries of the Yangtze River in Sichuan Province had 14,000 km of navigable passes in the early 1950s and these decreased to 7,000 km by 1981. The expanse of locally navigable river decreased to 67 per cent of its former expanse between 1958 to 1981. Meanwhile the total length of navigable passes has decreased by 50 per cent. In Hubei Province, a similar situation can be found; the total length of navigable passes on the Yangtze mainstream and major tributaries was 19,330 km in 1960 but only 7,879 km in 1979.

Silting and Shrinking of Lakes

Soil erosion in the upper reaches of the rivers causes the silting and shrinking of lakes in the middle and lower reaches of rivers.

In the middle and lower reaches of the Yangtze, Huaihe, Zhuljiang, and other rivers, numerous lakes are distributed, and their total area is 22,161 sq.km., accounting for 27.5 per cent of the total lake area in China. Poyang Lake is China's largest freshwater lake with an area of 5,050 sq.km. The Gan, Fu, Xishui, Po, and Xin rivers converge into this lake and merge with the Yangtze. During recent years the lake area has decreased to 3,583 sq.km. because of silt deposits and reclamation of land. Dongting Lake is China's second largest freshwater lake. The Xian, Zishui, Yuan, and Lishui rivers converge into this lake and merge with the Yangtze River at Chenglingji in Yueyang County. From 1949 to 1976, the lake's area decreased from 4,350 sq.km. to 1,840 sq.km. owing to silt deposits carried by the rivers and reclamation of land. It is estimated that about 200 million tonnes of sediment silt each year result in an increase in the lake bed of four centimetres per annum. Figure 5.1 shows the variation of Dongting Lake in area and water storage over time (Editing Commission for the "Physical Geography of China" 1981).

The Dongting Lake plays an important role in regulating the river flow and peak flow of the Yangtze River. This role is being weakened, however, because of a decline in water storage caused by silting and shrinking of the lake. The lake is one of China's major freshwater aquacultural centres. Catches from the lake accounted for 80 per cent of the total fishing in Hunan Province in the past, but, in recent years, the fishing has declined sharply, especially the total catches of quality fish which have decreased to four per cent of the total catches in the whole province.

Silting of Water Conservancy Projects

According to survey data in Sichuan Province, the total annual siltation of 73,079 conservancy projects is 46.19 million cubic metres, which reduces the area irrigated by 8,186.67 ha each year. Reservoirs in the Tuo, Fu, and Jialing basins in Sichuan Province have average siltation rates of more than one per cent. (Commission Office for Soil-Water Conservation 1990). Gongzu Water Power Station, which is the largest in southwestern China with a 35 million cubic metres reservoir capacity, has 11.4 million cubic metres of silt 10 years after its construction, accounting for 30 per cent of the reservoir's total capacity - the average siltation rate being more than 3.5 per cent (Fang Zheng San 1987).

Data from the Soil-Water Conservation Office at Mianyang, Sichuan Province, in 1987, pointed out that the total annual siltation of water conservation works in the district was 7.90 million cubic metres of which 308 million cubic metres was in the reservoirs alone. There are 2,483 river weirs in the district and 1,100 weirs have serious siltation problems; 450 weirs have almost gone out of operation. From the beginning of operation to 1987, Longzu reservoir in the district has lost 210,000 cubic metres in capacity because of siltation, Beiping reservoir with 4,20,000 cubic metres live capacity has been silted to the extent of 210,000 cubic metres. In general, the annual total losses in reservoir capacity in Sichuan

Province amount to 100 million cubic metres which means the province lost one large-scale reservoir per annum.

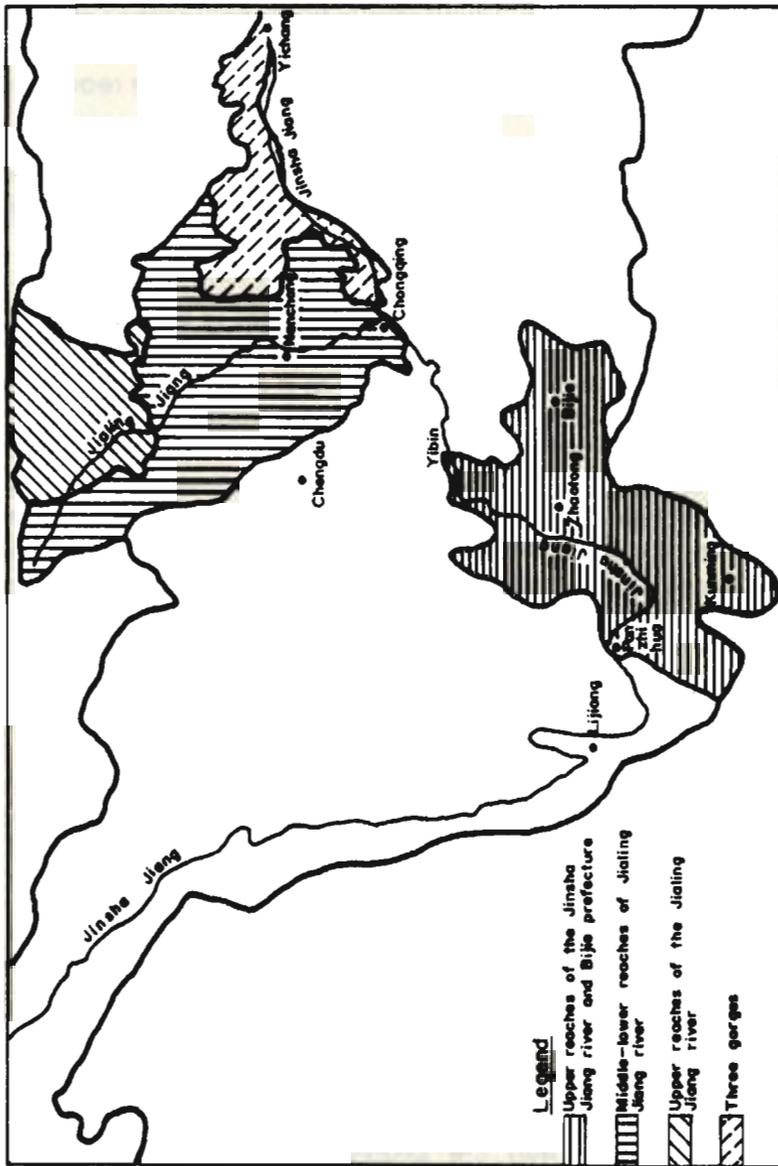
Reducing the Effective Use of River Flow

In China most of the rivers are fed by precipitation and the seasonal variation is uneven because of the monsoon. Soil erosion in mountain areas can aggravate the status of river flow. During peak periods, large amounts of water flow into the sea without effective use, thus reducing the use of runoff and river flow. For instance, in Minjiang River (the largest river in Fujian Province), 57,000 million cubic metres flow is lost each year, accounting for nine per cent of the total flow, because of the lack of effective use.

Degradation of Eco-environmental Conditions and Poverty in Soil Erosion-prone Areas

Until now, some places in soil erosion-prone areas in the Upper Reaches of the Yangtze are operating at subsistence level. In Guizhou Province, there are 11 poor counties in the Yangtze Basin, of which 10 counties are prone to soil erosion. In Yunnan Province, 71.4 per cent of the poor counties are located in areas seriously affected by soil erosion. In the target area for water and soil conservation in Yunnan Province, deficiency of grain, fuel, and timber amounted to 32.57 million kg, 0.1138 million tonnes, and 18,900 cubic metres respectively in 1987; wells, springs, and ponds have dried up and it is difficult to irrigate farmland and for people and livestock to receive enough safe water to drink (Commission Office for Soil-Water Conservation 1990).

Figure 5.1: Variation of Dongfjin Lake in Area and Water Storage Over Time



Source : Editing Commission for the "Physical Geography of China" 1981