

SOCIOECONOMIC STATUS IN THE UPPER REACHES OF THE YANGTZE

Soil erosion is an integrated process which depends on natural and socioeconomic conditions. Human activities can trigger or accelerate soil erosion in many ways.

The Chengdu Institute of Mountain Disasters and Environment calculated the contribution of natural factors and socioeconomic factors to soil erosion and concluded that the contribution of natural and socioeconomic factors to soil erosion is 40.62 per cent and 58.8 per cent respectively (Chengdu Institute of Mountain Disasters and Environment 1990). This means that socioeconomic factors are more critical for soil erosion, therefore the socioeconomic situation in the upper reaches of the Yangtze should be taken into consideration.

Administrative Demarcation and Population

The drainage system of the upper reaches of the Yangtze covers Tibet, Yunnan, Sichuan, Guizhou, Hubei, Gansu, Shanxi. The high priority area for water-soil conservation in the upper reaches of the Yangtze covers 152 counties administered by 25 prefectures (cities), accounting for 304,000sq.km. of which 65,900sq.km. is in Yunnan Province, 25,600sq.km. in Guizhou, 158,700sq.km. in Sichuan, 5,600sq.km. in Hubei, 38,200sq.km. in Gansu, and 10,000sq.km. in Shanxi. The total population of the area is 65.3393 million, of which the farming population numbers 59.3526 million. The average population density is 215/km² and this varies from place to place. For instance in Southern Shanxi, the population density is 68/km², but in the high mountain area it is only 34/km². The detailed data on population are listed in Table 3.1 and are noted in Figure 3.1.

Agriculture in the Region

Agriculture in the upper reaches of the Yangtze is characterised by high percentages in gross industrial products and agriculture and high percentages in the planting sector.

According to 1988 data for agricultural production in 15 counties, in the middle-lower reaches of the Jialing, agricultural grasses account for 58.38 per cent of the gross industrial and agricultural product. In terms of gross agricultural product the cultivation sector has the largest percentage. For example, the 1988 agricultural data for high priority areas in the upper reaches of the Yangtze indicate that the gross product of the cultivation sector is 3.397 billion US\$¹ accounting for 57.1 per cent of the gross agricultural product (Commission Office for Soil-Water Conservation 1990). The crops cultivated are mainly food species. The area under food crops accounts for 80 per cent of the total area sown and only 20 per cent of the area is used for cash crops. The commercialisation of crops like tobacco is low. The constraints to cultivation are outlined below.

The paddy and terrace areas are small, and the dry sloping farmland area is large. In most of the rural areas about 60 per cent of the land is subjected to extensive farming, land is left fallow, and slash-and-burn cultivation is still carried out in some localities. In some mountainous areas, extensive cultivation is still practised. When disasters occur, the harvests are poor and do not meet the demands of the local people for food.

¹ In 1988 there were 3.45 yuan to the U.S. Dollar.

Table 3.1: Population in High Priority Areas for Water - Soil Conservation in the Upper Reaches of the Yangtze (based on 1988 data)

High Priority Area	Province	No. of counties	Population (10 ⁴)		Agricultural labour force (10 ⁴)	Population density (per km ²)
			Total	Agricultural population		
Lower-reaches of the Jinsha and Bijie district	Yunnan	36	914.67	824.03	370.81	139
	Guizhou	8	542.64	513.34	203.79	212
	Sichuan	13	262.31	228.21	94.13	96
Subtotal	3	57	1719.62	1565.58	668.73	145
Southern Gansu & Southern Shanxi	Gansu	15	266.11	249.58	112.12	70
	Shanxi	6	63.02	56.72	18.76	63
Subtotal	2	21	329.13	306.30	130.88	68
Middle-lower reaches of Jialing	Sichuan	47	3662.08	3378.08	1593.64	325
Subtotal	1	47	3662.08	3378.08	1593.64	325
Three Gorges' District	Sichuan	22	740.51	607.32	289.32	394
	Hu Bei	5	82.59	77.98	34.51	148
Subtotal	2	27	823.10	685.30	323.83	338
Total	6	152	6533.93	5935.26	2717.08	215

Source: Commission Office for Soil-Water Conservation 1990

Population

There is an uneven distribution of population. For example, in the Wu Basin, the population density decreases in line with the middle reaches (average density: 233/km²) > upper reaches (average density 204.6/km²) > lower reaches of Sichuan province (average density 167.1/km²); and it is a minority area settled by more than ten minorities (mainly Yi, Miao, Hui, Tibetan, and Naxi).

The educational level is lower than in the coastal areas of China. Three educational indicators are taken into consideration.

The illiteracy rate in the Wu Basin is 31.2 per cent, which is 50 per cent higher than the average in junior secondary school (grades 6 to 9). Enrollment ranges from 10 to 20 per cent and the average educational level (schooling years) ranges from 2.3 to 5.2 years.

There is quite a large labour force, but absorbing the surplus labour is an urgent concern. According to the second census of Guizhou Province (1982), the working population in the province accounts for 51.09 per cent of the total population (Table 3.2).

Another example is that, in the Wu Basin, the rural labour force roughly accounts for 33.8 to 44.9 per cent of the total agricultural population. The variations in terms of specific area are 38 to 44 per cent for the upper reaches of the Wu, 33.8 to 43.7 per cent for the middle reaches, and 40 to 44.9 per cent and 40.1 to 44.5 per cent for the lower reaches of the Wu in Guizhou and Sichuan respectively (Chengdu Institute of Mountain Disasters and Environment 1990).

Table 3.2: Population Breakdown by Age Group

Age Group	1964 Census		1982 Census	
	Total population (10 ⁴)	% of total population	Total population (10 ⁴)	% of total population
Total	1714.05	100	2855.29	100
Under one year	83.48	4.86	76.69	2.69
Preschool (1-6 years)	406.61	23.72	415.15	14.53
7 - 14 yrs	339.37	19.79	675.47	23.68
18 - 22 yrs	154.71	9.02	215.53	7.54
Females of child bearing age 15 - 49 yrs)	298.14	23.22	635.13	22.24
Active labour force males 16 - 59 yrs females 16 - 55 yrs	922.94	53.84	1458.96	51.09
Retired males > 60 females > 55	146.55	8.55	229.64	8.88

Source: Population Census Office of Guizhou Province 1990

The farming population is much larger than the urban population. For instance, the urban population in the Wu Basin is only 11.3 per cent and the agricultural population accounted for 88.7 per cent (1986 Census) and 86.8 per cent (1988 census) of the total population in two consecutive census reports.

Economic and Living Conditions in the Upper Reaches of the Yangtze

Some economic indicators are selected and given in Table 3.3 which gives a general analysis of the rural economy and living conditions in the region.

In the vast rural area of the region some constraints to socio-economic development still persist. Low per capita grain output is, for example, in the Wu Basin 31.2 per cent of the counties' per capita grain is less than 200kg, which is far lower than the level of sufficiency - 300kg. Poverty is another constraint in 61.9 per cent of the total counties in the Wu Basin. The per capita net income of the agricultural population is about 191 *yuan*, or approximately 55.36 US\$, which is lower than poverty line - 200 RMB or (57.97 US\$) (Chengdu Institute of Mountain Disasters and Environment 1990).

Table 3.3: Selected Economic Indicators

(based on 1988 data)

Area of water and soil conservation	Province	# of County	Total Area (sq.km.)	Area of Farmland (10 ⁴)	Per capita farmland in agricultural sector (ha/capita)	Total output of grain (10 ⁴ kg)	Unit output of grain (kg/ha)	Per capita output of grain in agricultural sector (kg/capita)	Gross value of agricultural output (10 ⁴ US\$*)	Per capita net income in agricultural sector (US \$/capita*)
Lower reaches of the Jinsha and Bijie district	Yunnan	36	65921.80	110.98	0.135	217246.0	2175	264	67145.41	75.36
	Guizhou	8	25607.00	120.14	0.234	107300.0	2310	209	29034.78	52.75
	Sichuan	13	27223.65	18.41	0.081	86035.0	4665	4665	20321.16	73.91
Subtotal	3	57	118752.45	249.53	0.159	410581.0	2340	262	116501.35	67.83
Southern Gansu and Southern Shanxi	Gansu	15	38199.50	66.29	0.265	58790.0	1635	236	22227.04	53.33
	Shanxi	6	10039.00	9.30	0.164	21610.0	2325	381	5426.55	72.75
	Subtotal	2	21	48238.50	75.59	0.247	80400.0	1710	262	27653.59
Middle-lower reaches of the Jialing	Sichuan	47	112674.40	225.74	0.067	1501500.0	6645	444	360521.74	78.55
	Subtotal	1	47	112674.40	225.74	1501500.0	6645	444	360521.74	78.55
	Three Gorges	Sichuan	22	18777.40	42.69	200060.0	4680	329	79699.96	57.39
	Hubei	5	5589.67	6.16	0.079	25770.0	4185	330	9760.12	81.74
Subtotal	2	27	24367.07	48.85	0.071	2225830.0	4620	330	89460.08	60
Total	6	152	304032.42	599.72	0.101	2218311.0	4110	374	594136.76	72.17

* The exchange rate between US\$ \$ and the yuan in 1988 was 1 US\$ = 3.45 yuan

Source: Commission Office for Soil-Water Conservation 1990

Natural Resources

The Upper Reaches of the Yangtze are rich in natural resources, providing a good foundation for development agriculture, forestry, husbandry, and diversifying the economy. There is a variety of climates which are favourable for agricultural development.

Forest resources are insufficient but vast mountainous areas with good thermal and water conditions can provide for the development future of forestry.

There are large areas of natural pasture land but they are degraded by overgrazing.

Land Use

According to data collected from 152 counties in the upper reaches of the Yangtze, the total farmland area is 7.830 million ha, accounting for 25.75 per cent of the total land, of which 2.161 million ha are paddy land accounting for 27.60 per cent of the total farmland. Terraces occupy 10.23 per cent of the 0.801 million ha. Sloping farmland accounts for 62.17 per cent of the farmlands or total farmland.

Forest land occupies 43.65 per cent of the total land, pasture land, 12.88 per cent, water 3.01 per cent, barren land 6.10 per cent, waste land 8.61 per cent. Detailed data on land use in the region can be found in Table 3.4. The constraints to land use in the region are:

- the land is not fully used; and
- the sloping farmland areas are not improved; thin topsoil, low capacity to withstand drought, and low unit outputs make harvests unstable.

A high percentage of forest land is secondary forest, young plantation, and overmature forest with almost zero growth. Pasture land is being degraded and because of poor quality grasses the use value is low.

Land use in the region varies from place to place (Beijing Institute of Geography 1983).

- The Qinghai-Tibetan Plateau.** In pastoral areas, animal husbandry is prevalent in areas where the vegetation coverage is about 90 per cent. In the valleys, forestry and animal husbandry are prevalent. Maize, wheat, beans, highland barley, potatoes, rice, and radishes are cultivated at the rate of one crop per year, but two or three crops every two years are common in some places.
- The Hengduan Mountains.** The Hengduan Mountains are rich in forest resources and pastoral land, and the prevalent activities are forestry and animal husbandry. Agriculture only accounts for a small proportion of the total economy. The farmland is mainly distributed throughout the valleys and intermontane basins. In the warm valleys, two or three crops a year are produced with intensive cultivation, whereas, in mountainous areas, one crop a year is usual and highland barley, oats, and potatoes are cultivated extensively.
- The Yunnan - Guizhou Plateau.** On high mountainous pastoral land, animal husbandry is prevalent and, in mountain areas > 2,200masl, forests account for a large proportion of the total land. The land between 2000m to 2200masl rarely has vegetation and most of the forests have been cleared for farmland, most of which are cultivated extensively. Most land areas below 2000masl are used as farm-land. In the valleys below 1,200masl, double crops of rice and some tropical cash crops, for example, rubber trees and coffee, can be cultivated. Forested land accounts for 20 per cent of the total area on the Yunnan-Guizhou Plateau.

Table 3.4: The Current Status of Land Use in the Region (unit: 10⁴ ha)

Area	Province	Total land (area ¹)	Farm Land ²										Forest Land				Pastoral	Waters		Barren Land		Non-productive Land Use	
			Area	% of total land	Of Farm Land				Area	% of Total Land	% of Forest Land		Area	% of total land	Area	% of total land		Area	% of total land	Area	% of total land		
					Paddy	% of farm-land	Terrace	% of farm-land			Stpping farm-land	% of total farm-land										Forested land	% of total forest land
Total		3040.325	782.998	25.75	216.121	27.60	80.083	10.23	488.755	62.17	1327.177	43.65	841.706	63.42	391.581	12.88	91.383	3.01	185.551	6.10	261.863	8.61	
Lower reaches of the Jinsha & Jialing district	Subtotal	1187.525	267.885	22.57	40.773	15.21	34.558	12.90	192.655	71.89	575.113	48.43	351.876	61.18	228.463	19.24	21.911	1.85	23.203	1.95	70.783	5.96	
	Yunnan	659.218	110.980	16.84	23.069	20.80	11.296	10.18	78.595	89.02	367.855	55.80	201.87	54.88	124.185	18.84	18.019	0.68	n.a.	n.a.	18.952	6.09	
	Guizhou	256.07	120.145	46.82	9.889	9.31	17.257	13.34	92.932	77.86	67.872	26.51	55.313	61.50	47.353	20.91	4.145	1.52	22.668	8.55	11.862	4.28	
	Sichuan	272.337	36.861	13.54	7.694	20.88	6.039	16.38	23.128	62.74	139.285	51.20	94.893	67.83	56.925	20.91	4.145	1.52	22.867	5.87	40.084	8.31	
Southern Gansu & Southern Shand	Subtotal	482.385	81.161	16.82	0.761	0.96	11.879	14.64	68.501	84.40	258.458	53.58	210.329	81.38	68.819	13.85	12.330	1.87	26.887	5.87	40.284	8.31	
	Gansu	391.995	66.789	17.36	n.a.	n.a.	10.038	15.14	56.251	84.86	182.600	47.80	158.138	66.89	63.607	16.65	7.802	2.04	26.867	5.03	34.830	9.13	
	Shanxi	100.390	14.872	14.81	0.781	5.25	1.841	12.36	12.250	82.37	75.858	75.56	52.191	66.80	3.211	3.20	1.19	n.a.	n.a.	5.254	5.24		
Middle-lower reaches of the Jialing	Subtotal	1126.744	327.328	29.10	156.793	47.90	24.549	7.50	145.985	44.60	433.658	38.50	238.539	55.0	74.574	6.60	54.505	4.80	107.747	9.80	128.635	11.40	
	Sichuan	1126.744	327.328	29.10	156.793	47.90	24.549	7.50	145.985	44.60	433.658	38.50	238.539	55.0	74.674	6.60	54.505	4.80	107.747	9.80	128.635	11.40	
Three Gorges	Subtotal	243.871	106.094	43.70	17.775	16.89	9.107	8.55	79.813	74.76	59.948	24.60	40.963	68.33	21.626	8.89	5.373	2.45	27.667	11.36	21.961	9.01	
	Sichuan	187.774	99.449	52.98	16.873	16.97	8.91	8.08	73.865	74.04	39.872	21.23	25.162	63.11	17.627	9.32	4.671	2.49	12.373	6.59	13.783	7.34	
	Hubei	55.897	7.046	12.61	0.901	12.79	0.197	2.79	5.948	84.42	20.076	35.82	15.901	78.70	4.000	7.15	0.703	2.33	15.295	27.36	8.178	14.63	

Source: Commission Office for Soil-Water Conservation 1990

(a) and (b). The total land area and farmland in the table is a little different from those in Table 3.3, because of a difference in coverage of study area

¹ 1 ha = 15 mu, the mu is a farmland unit in China. 1 mu = 666.66 sq.m.

The barren land accounts for 50 per cent of the total land area and is mainly covered with grass and shrubs following the disappearance of other vegetation-leading to the possible intensification of soil erosion. Farmland accounts for only 10-15 per cent of the total area, and one crop a year is prevalent in mountainous areas where maize and potatoes are cultivated. On the intermontane basins and flatlands, two crops a year are grown, e.g., rice, wheat, broad beans, cole, etc. Cash crops, for example, tobacco, sugarcane, wood oil trees, timber stock, tea, and some fruit trees, are grown extensively in this area. The irrigated farmland area is larger than the dry farmland area and irrigated farmlands are mainly distributed throughout the intermontane basins, along the banks of rivers, and along lake-shore lowlands with high and stable agricultural outputs. Dry farmlands are mainly found on the slopes of hills and on low mountains where soil erosion is intensified.

- d. The Sichuan Basin. The Sichuan Basin, in the foothill areas, is an agricultural area and has a high multiple crop index of about 175-250 (Figure 3.2). Farmland area accounts for 40-50 per cent of the total area although this varies from place to place. More than 70 per cent of the farmland is situated in the lowlands and hills and 10-20 per cent is situated in the mountains.

Mountain Agriculture. Most of the Upper Reaches of the Yangtze are mountainous areas. Table 3.5 shows the different mountains in China.

Table 3.5: Morphological Classification of Selected Provinces (Number of County and Prefecture)

Selected provinces	High mountains	Middle and low mountains	Hills	Plateaux	Plateaux plains	Plains
Qinghai	3	13	--	21	3	--
Tibet	53	--	--	19	--	--
Yunnan	6	108	15	--	--	--
Guizhou	--	35	48	--	--	--
Sichuan	8	75	74	21	-	17
Total	70	231	137	61	3	17

Source: Chengdu Institute of Mountain Disasters and Environment 1983

From Figure 3.2 (2.47) and Table 3.5, it can be seen clearly that mountain agriculture plays an important role in the socioeconomic development of the upper reaches of the Yangtze.

Vertical Distribution of Agriculture In Mountainous Areas in the Upper Reaches of the Yangtze

At present, agricultural production in the mountainous areas of the region generally follows the vertical distribution of climate and land use (i.e., "stereo-agriculture"). This can clearly be observed in the Hengduan Mountains. From the valleys of the Jinsha (< 1,000masl), up to the western plateau of Sichuan Province (> 4,500masl) the climatic regime is: subtropical valleys (lower part), subtropical valleys (upper part), warm temperate, cool temperate, cold temperate, alpine, and cold alpine, and farming systems vary accordingly (see Table 3.6).

This vertical distribution of farming systems can be found in southwestern Sichuan Province. Taking Xichang District as an example, different farming systems have been classified.

Table 3.6: Vertical Distribution of Agriculture in Western Sichuan Province and Northern Yunnan Province

Climatic regime	Accumulated temperature (> 10°C)	Growing period in days (> 5°C)	Average monthly temperature of hottest month	Crops	Crop system	Animal husbandry
Cold alpine	--	--	< 10°	No crops No trees	--	Yak and domestic sheep
Alpine sub-cold	About 300°	< 130	10-11	Food crops do not mature, vegetables, linen, and sugar beet are planted locally	One crop per annum	Husbandry dominated by cattle, <i>pien-niu</i> *, goats and pigs
Cold temperate	900-1800	170-210	12-15	Spring wheat	One crop per annum	Agriculture and husbandry are practised equally; diversified livestock
Cool temperate	2300-3000	220-270	16-17	Spring wheat, early maize, and middle maize	One crop per annum dominated	Animal husbandry
Warm temperate	3200-4000	280-310	18-20	Winter wheat, middle-late maize	Two crops per annum	No yak and <i>pien-niu</i> buffalo
Subtropical valley (upper part)	4200-6000	300-365	21-23	Rice, middle late-maize	Two crops per annum locally	Buffalo
Subtropical valley (lower part)	6600-7700	365	24-25	Double cropping rice, cotton, sugarcane, coffee, maguey, hemp, bananas	Three crops	Buffalo

* *pien-niu*, offspring of a bull and a female yak

Source: Chengdu Institute of Mountain Disasters and Environment 1983

Dry and Hot Valleys

The dry and hot valleys include valleys in the lower reaches of the Anning River (below Miyi County), the lower reaches of the Yalong and the Sanyuan River valleys, and the Jinsha valleys.

These valleys have good thermal conditions (accumulative temperature >10°, ranges 6,800° to 7,500°C and less precipitation (annual precipitation is from 600mm to 1,100mm), and, on irrigated farmland, three crops can be harvested.

Wide Valleys and Basins

The wide valleys and basins include the wide Anning River Valley, Hulli Basin, Huldong Basin, Ningnan Basin, and Yanyuan Basin. The growing period lasts up to 10 months. The multiple cropping index is about 170 per cent.

Middle and Low Mountains

The middle and low mountainous areas are large and most of the farmland is dry sloping farmland. Paddy fields are located at the base of the mountains. One crop per annum is prevalent but, in the lower area of the zone, two crops per annum can be grown.

High Mountains

The high mountainous areas of the cool temperate zone produce one crop per annum. The major crops are potatoes, beech wheat, and highland barley. At lower elevations, early maize and middle maize are planted. The multiple cropping index is 138 per cent.

The vertical distribution of farming systems, described above, is shown in Table 3.7 (Chengdu Institute of Mountain Disasters and Environment 1980).

Table 3.7: Vertical Distribution of Farming Systems in the Xichang District of South Western Sichuan Province

	High mountains, > 2400masl	Middle and low mountains, 1200-2400masl	Wide valleys and basins, 1200-1800masl	Dry and hot valleys, 600-1300masl
Climatic conditions	Annual average temp.: < 13°C; accumulative temp > 10° < 3,600°C; frost-free period <210 days; annual precipitation < 900mm	Annual average temp. : 15 to 13°C; accumulative temp. > 10°C: 4,800 -3,600°C; frost-free period: 240 to 210 days; annual precipitation: 900 to 1200mm	Annual average temperature: 19 -15°C; accumulative temperature > 10°C : 6,800 to 4,800; frost-free period: 290-240 days; annual precipitation: 900 to 1200mm	Annual average temperature: 21° to 19°C; accumulative temperature > 10°: 7,500 to 6,800°C; frost-free period: 320 to 290 days; annual precipitation: 600 to 1,100mm
Land use	Forest, grassland dominated, a few farmlands	Forest dominated, some farmlands	Farmland dominated	Farmland dominated
Cropping system	One crop per annum	One crop or two crops per annum	two crops per annum	Three crops per annum
Crops	Potatoes, beech, wheat	Maize, rice, potatoes	Rice, wheat, cole, tobacco, sugarcane	Double cropping rice, sugar cane, tropic crops
Livestock	Yak, domestic sheep	Goats, cattle	Buffaloes, pigs	Buffaloes, pigs, goats
Forests	Mixed needle and broad-leaved forests, needle-leaved forests	Deciduous forests, Yunnan Pine forests	Evergreen broad-leaved forests, Yunnan Pine forests	Shrubs, tropical trees, shellac

Source: Chengdu Institute of Mountain Disasters and Environment 1980

Mountain Agriculture and Soil Erosion

In the Upper Reaches of the Yangtze River, soil erosion on the slopes mainly occurs on dry sloping farmland where protection measures have not been taken. Food crops and cash crops on sloping farmland in the region have no dense coverage, especially in the early strong seedling period. Crop coverage is 50 per cent in the young seedling period, and the crop coverage scant meaning that, with heavy rain, the soil is subject to serious erosion.

In the hilly areas of the Sichuan Basin, dry farmland areas produce two crops per annum. The rotation system is simple: wheat - sweet potatoes, wheat - peanuts, wheat - sorghum, peas - sweet potatoes, peas - cotton peas - maize. In these areas, the rainy season starts in late May or early June, when the crops are in the budding or young seedling stage, loose soil and low crop coverage (< 20 %) does not preserve the soil from erosion. Work in this area points out that the soil loss on fallow land after the wheat is harvested in May accounts for 20 per cent of the annual total soil loss, in some places up to 50 per cent. July is the peak month for precipitation in the hill areas of the Sichuan Basin with high precipitation intensity, while 50 per cent crop coverage is less. Therefore, soil erosion is extensive (see Table 3.8).

Table 3.8: Precipitation and Soil Water Losses on Dry Farmland

Item/ Month	Precipitation (mm)	Precipitation of runoff (mm)	Yield against total precipitation	Runoff (m ³ /ha)	Sediment discharge (kg)
May	264.0	216.7	82	12.3	101.2
June	166.5	81.6	49	3.15	1.6
July	246.7	201.3	82	133.5	467.0
August	125.0	87.8	70	33.0	15.9

Source: Experimental Station of Water and Soil Conservation, Suining County, Sichuan Province, 1986

Here along the mountainous borders of the Sichuan Basin in the west of the province (> 1000masl) only one crop per annum, such as maize or potatoes, is planted on sloping farmland.

From the work carried out on agriculture and soil erosion, a number of points have arisen.

Soil erosion on farmland is related to crops, crop combinations, and sowing time. Table 3.8 lists information and data concerning this relationship which were obtained from Neijiang County in Sichuan.

From Table 3.9 it can be observed that water and soil losses are ranked in descending order as follows: fallow land > maize + peas > sorghum + peas > peas + cole > grassland.

Root System in Grassland and Soil Erosion

The laboratory data on soil disintegration in still and flowing water are listed in Table 3.10. The soil samples are from pea fields, wheat fields, and barren land without crop cover. From Table 3.10 it can be seen that the disintegration of soils sampled from pea fields in still water and in flowing water and from wheat fields are lower than ones from soil sampled from new barren land without crop cover. Because there are fewer roots in the soil samples taken from new barren land, they have lower disintegration rates than the samples from pea and wheat fields, because these latter tend to have more roots in the samples, most being found in the samples taken from pea fields. Barren land should be quickly revegetated. The water-stable granular structure of purple soil varies under different kinds of vegetation, including crops.

Table 3.9: Soil and Water Losses on Farmlands with Different Crop Combinations and with Grass Cover

Item	Annual runoff (m ³ /ha.)		Annual soil loss equal to soil depth (mm)	Note
Fallow land	2445.0	167.41	11.0	12° slope for all pilot plots
Maize + peas	2142.0	87.06	5.7	
Sorghum + wheat	----	75.71	5.1	
Peanuts + cole	1968.0	53.74	3.6	
Grass cover	1525.3	23.59	1.1	

Source: Neijiang County, Sichuan Province, 1986

Table 3.10: Soil Disintegration and Crop Roots in Soil

Crop	Soil sampling depth (cm)	Soil disintegration in still water (% against total volume of soil sample)	Soil disintegration in flowing water (% against total volume of soil sample)	Roots (g/kg)	Note
Pea fields	0 - 5	10	10	5.39	Yellow-drab soil developed on quaternary deposits
Wheat fields	0 - 6	15	20	1.28	
Barren land with no crop cover	0 - 5	30	35	a few	

Source: Northwestern Institute of Soil and Water Conservation 1986

From Table 3.11 It can be observed that the portion of water-stable granules of > one mm in soil with perennial herbs is 66.0 per cent. for mixed Alder and Cypress forest it is 57.7 per cent, and in maize fields it is only 5.6 per cent to 5.8 per cent. This means that perennial herbs function well in conserving the soil.

Therefore in agricultural areas in the hills and lower mountains, the land use systems for agriculture, forests, and animal husbandry should be reasonably proportioned and husbandry should be developed along scientific lines.

Forestry in the Region

In areas where there is high priority for water-soil conservation the forested land is 8.147 million ha, but the forest resources are not abundant. For example, in the lower reaches of the Jinsha, the forested land covers 2.966 million ha with 98.864 million cubic metres of living timber stock. The per capita average living timber stock is 7.6 cubic metres and 1.56 cubic metres in the lower reaches of the Jinsha and Bijie district respectively. These figures are lower than the per capita average of 10 cubic metres for China as a whole.

Among the problems are uneven distribution of forest resources. Forests are mainly found in the lower reaches of the Jinsha and the upper reaches of the Jialing. Some forests are situated in inaccessible high mountain areas, therefore they are not easy to harvest.

Table 3.11: The Water-Stable Granular Structure of Purple Soil under Vegetation

Vegetation		> 5	5-3	3-2	2-1	1-0.5	0.5-0.25	> 0.25	> 1	> 3
Mixed alder and cypress forest	Topsoil	31.42	14.08	5.95	6.27	8.94	3.92	70.58	57.72	45.5
	Sub-soil	7.79	4.55	2.30	3.34	8.49	6.47	32.94	17.98	12.34
Lalang grass	Topsoil	29.57	20.34	3.43	7.67	8.05	2.47	76.53	66.01	49.91
	Sub-soil	26.73	17.69	7.56	6.93	9.53	4.79	73.23	58.91	44.42
Maize (I)	Topsoil	1.43	2.12	1.25	2.00	4.82	4.75	16.37	5.80	3.55
	Sub-soil	1.19	1.65	0.98	1.82	5.78	5.44	16.86	5.64	2.84
Maize (II)	Topsoil	1.75	1.13	0.96	1.75	10.20	11.03	26.82	5.59	2.88
	Sub-soil	0.00	0.64	0.99	2.61	14.71	11.56	30.51	4.24	0.64

Source: Chengdu Institute of Mountain Disasters and Environment 1983

The composition of forests generally is not the best. Timber forests account for 80 per cent of the total forested area, with commercial forest, firewood, and protective forest covering 20 per cent of the area. Coniferous forests are of low quality and there are too many middle-aged and young trees.

Most forests are subjected to unbalanced cutting and planting. In most cases plantation does not keep up with cutting.

Table 3.12 gives an example of forest composition in the lower reaches of the Jinsha.

Table 3.12: The Composition of Forests in the Lower-Reaches of the Jinsha

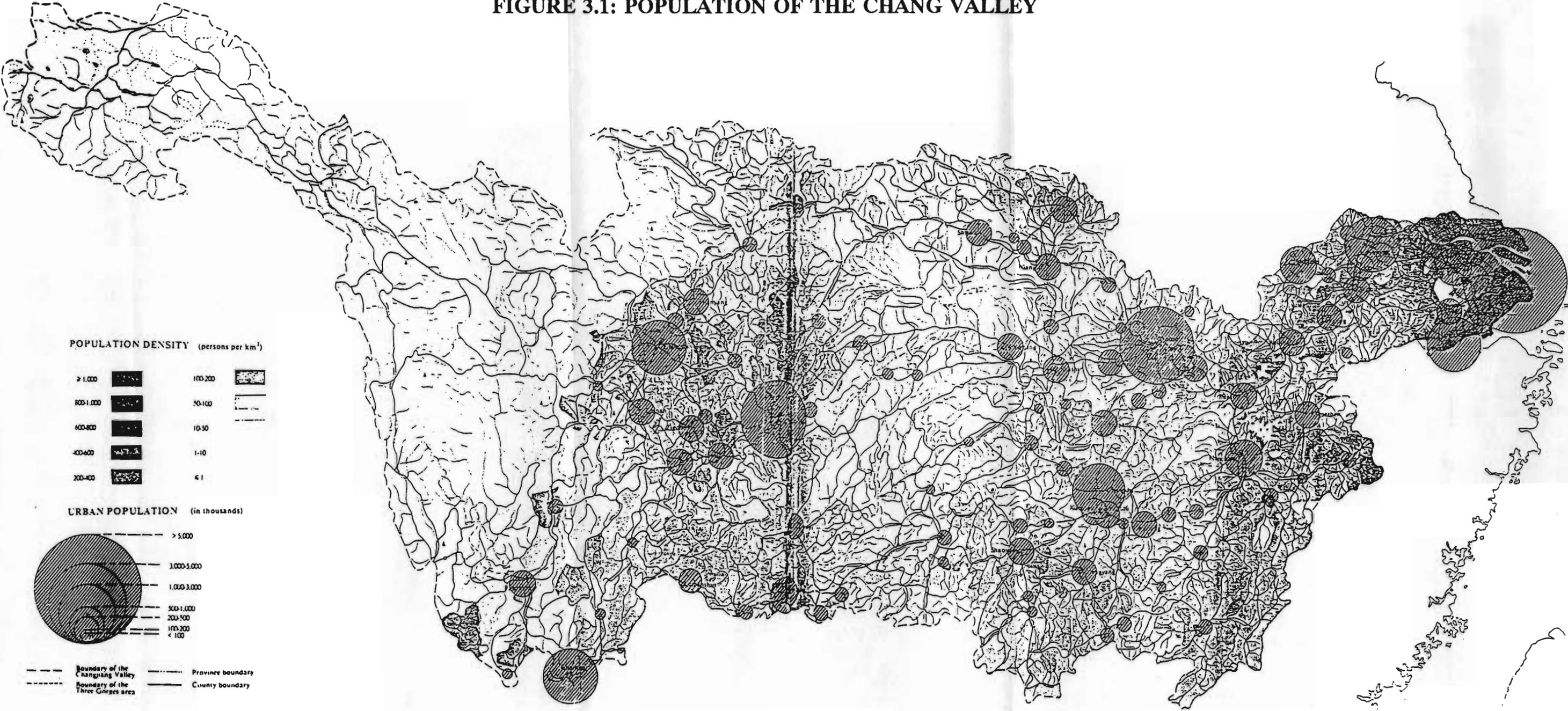
District	Forested land (excl. bamboo forest)	Timber forest		Protective forest		Cash forest		Firewood forest		Forest for specific purposes	
		Area	% of forested land	Area	% of forested land	Area	% of forested land	Area	% of forested land	Area	% of forested land
Sichuan	54.923	43.080	78.4	6.639	12.1	3.134	5.7	0.910	1.7	1.160	2.1
Yunnan	96.647	6.120	91.8	4.371	4.5	2.6545	2.7	0.867	0.9	0.055	0.1
Total	151.570	131.790	86.91	11.009	7.3	5.779	3.8	1.777	1.2	1.215	0.8

Source: Commission Office for Soil-water Conservation 1990

Animal Husbandry in the Region

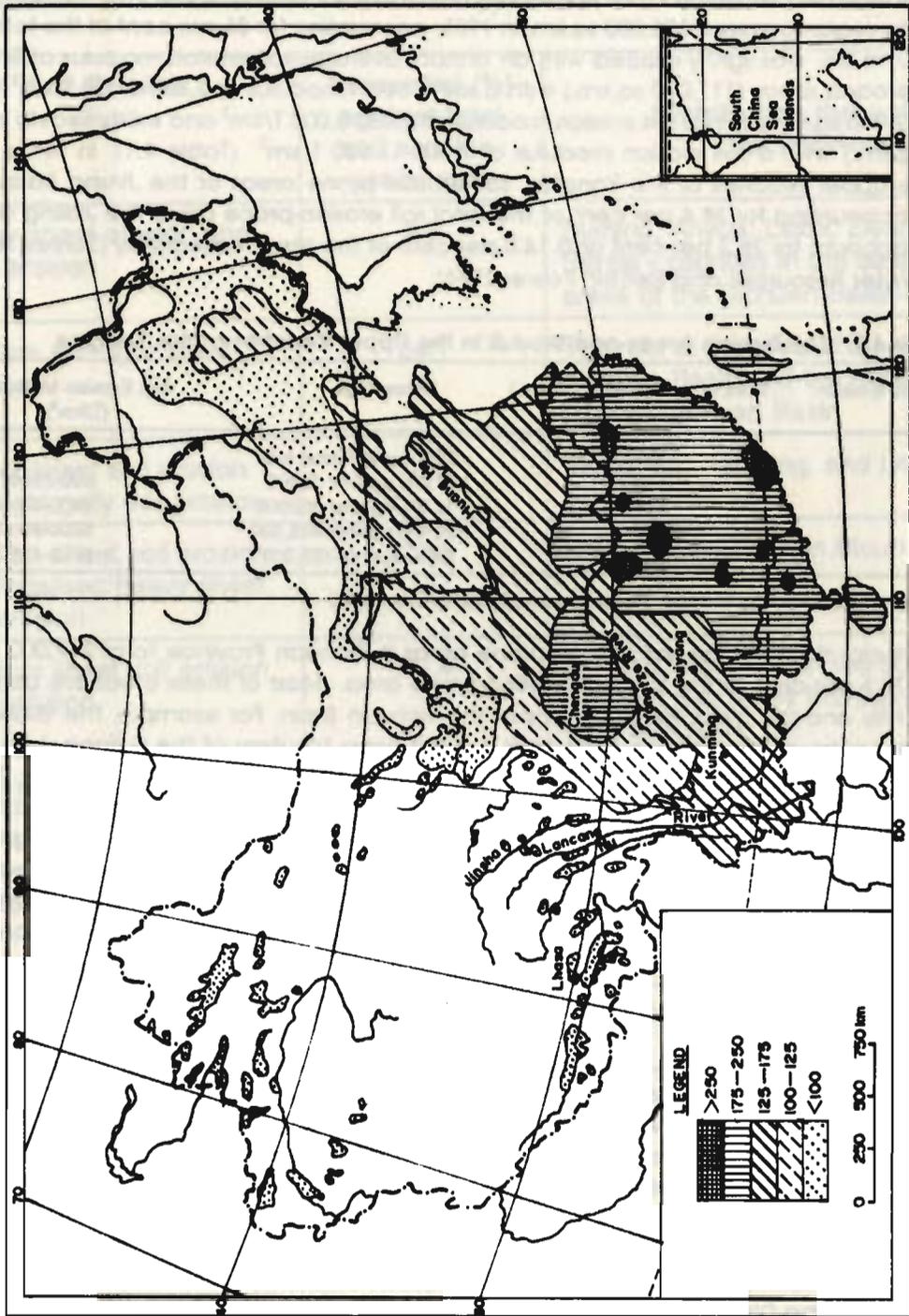
Pig raising and sheep raising are major sectors in animal husbandry in the region. Large-sized livestock include cattle and horses. At present, animal husbandry is basically reliant on natural conditions. Degradation of pasture land, overgrazing, and short supply of winter hay constrain development of animal husbandry in the region. In Liangshan Prefecture, livestock productivity per hectare is 5.043 US\$ (Commission Office for Soil-Water Conservation 1990).

FIGURE 3.1: POPULATION OF THE CHANG VALLEY



Source: Zhao Songqiao 1986

Figure 3.2: Multiple Crop Index In China



Source: Beijing Institute of Geography 1983