

INTRODUCTION

"Soil is a crucial life-support system, since the bulk of all food production depends upon it."

- World Conservation Strategy

Teaming with life of myriad forms - soil, flora, and fauna, soil deserves to be classified as an equal system in itself or rather as many ecosystems. Therefore, the soil system has its own specific functions, structure, and products. One important function is the stabilisation of the nutrient cycle of soil-based ecosystems, for example, agriculture and forests. Without a soil system, there would be no soil-based ecosystems, even human beings would not be able to survive. Soil erosion reduces the inherent carrying capacity of the land because both loss of nutrients and degradation of the physical structure increase the cost of food production. Soil erosion may compromise economic progress and even political stability.

Soil erosion in mountain areas is an integral element in the following cycle: population growth - unreasonable use of natural resources and marginal land use - degradation - soil erosion - distribution of the water balance in watershed - degradation of mountain ecosystems - unsustainable development - poverty. Therefore, one major concern in sustainable development is how to form land without losing soil.

In China, the fourth major food-producing country in the world, dust storms and siltation in the major rivers cause heavy soil losses. According to a rough global estimate, China's excessive loss of topsoil from its crop lands totals 4.3 billion tonnes per year. Information on soil erosion from various regions in China indicates that soil erosion may be even more serious today than during the days of the founding of the People's Republic of China.

In the Yangtze basin, the soil erosion-prone area covers about 360,000sq.km., accounting for 20 per cent of the total basin area of which sloping farmland accounts for 18 per cent; commercial plantations four per cent; and barren land and foothills 78 per cent.

In the context of socioeconomic development, the Yangtze is a life-support river in China. Because of the large amount of discharge in the mainstream and tributaries of the Yangtze, there is a huge sediment discharge from the river, for example the sediment discharge recorded at Yizhang hydrometric station on the mainstream of the Yangtze is 500 million tonnes per year, of which about 200 million tonnes are transported into Dongting Lake. Because of siltation, the lake surface decreased from 4,700sq.km. in 1932 to 3,141sq.km. in 1958. The rapid increase of the Yangtze silt load has led many Chinese scientists to dramatise the worsening situation by stating that the river is becoming a second Yellow River. Even the former premier, Zhao Ziyang, used this in his exhortations for accelerated afforestation in the region.

The Yangtze is the longest river in China and one of the three largest rivers in the world. The mainstream of the Yangtze, from the head in Yushu county on the Qinghai-Tibetan Plateau, flows through Yunnan, Sichuan, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, and Shanghai until it enters the sea in the east, and it is about 6,300km. long. The Yangtze Basin is about 1.8 million sq.km., accounting for one fifth of the total area of China. The annual runoff into the sea is about 100,000 cubic metres, accounting for one third of the total runoff in China as a whole. The water power resources of the Yangtze are the largest in China; the total drop of the mainstream of the Yangtze River from head to mouth is more than 6,000m, and the total water power carried by the river accounts for 40 per cent of the total amount in China.

The total length of the upper Yangtze from the head to Yizhang is about 4,529km, accounting for 72 per cent of the total length of the Yangtze River mainstream. The basin area in the upper-reaches of the Yangtze River is 1.0006 million sq.km., accounting for 55.6 per cent of the total basin area of the river and 100.46 million people are living in the region, about 34 per cent of the total population in the Yangtze River Basin as a whole. Therefore, the upper reaches of the Yangtze occupy an important economic base in the river basin.

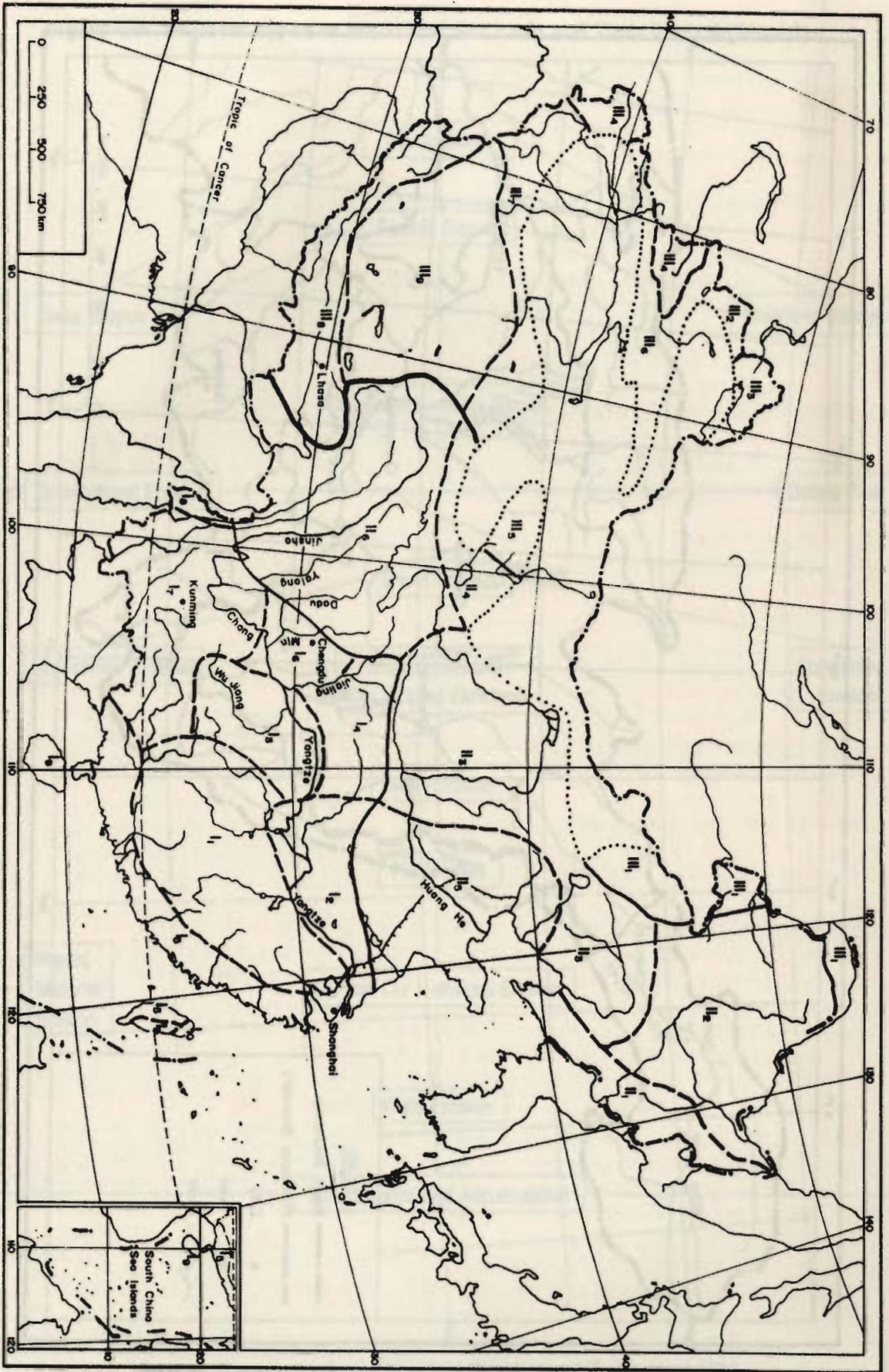
The upper-reaches of the Yangtze River mainstream drain Qinghai, Tibet, Yunnan, Sichuan, and Hubei, and the river is known as the Tong Tian River, the Jinsha, and the Chuan respectively. In the upper reaches of the Yangtze the first order tributaries on the left bank of the river are the Walong, the Minj, and the Jialing and on the right bank of the river the Wu, the Heng, and the Chisul respectively. The principal second order tributaries are the Dadu, the Annin, the Fu, and the Xiahangshui (see Figures 1.1 and 1.2) (Survey Team of the Ministry of Water Resources and Electric Power 1986).

In terms of socioeconomic development, the upper reaches of the Yangtze are characterised by rich natural resources and an underdeveloped economy. Water power, coal, and iron, account for 81.5 per cent, 67 per cent, 46 per cent, and 100 per cent of the total deposits in the whole of the Yangtze Basin respectively. But the total output from agriculture and industry in the region accounts for only 20 per cent of the output of the whole basin.

The economy in some parts of the upper reaches of the Yangtze has been historically exploited and developed since the founding of the People's Republic of China and, to a certain extent, the economy in these parts of the region has indeed developed. Nevertheless, because of irrational development and mistakes in policy-making, conflicts concerning population, resources, and environment have emerged, of which soil erosion as a serious problem has drawn the attention of the Chinese Government and of scientists at home and abroad. Therefore, for the sake of water and soil conservation and for the sustainable development of the region, the soil erosion in the upper-reaches of the Yangtze should be analysed systematically. In the upper reaches of the Yangtze, the physical components; for example, topography, geological structure, and climate are conducive to water and soil losses, through water erosion, gravitational erosion, wind erosion, glacial erosion, and debris flow. In general, glacial erosion and wind erosion are not serious and not widely distributed and will not be taken into consideration in this paper. Figure 1.3 gives the different types of water and soil losses in the region and their interrelationships (Chengdu Institute of Mountain Disasters and Environment 1988).

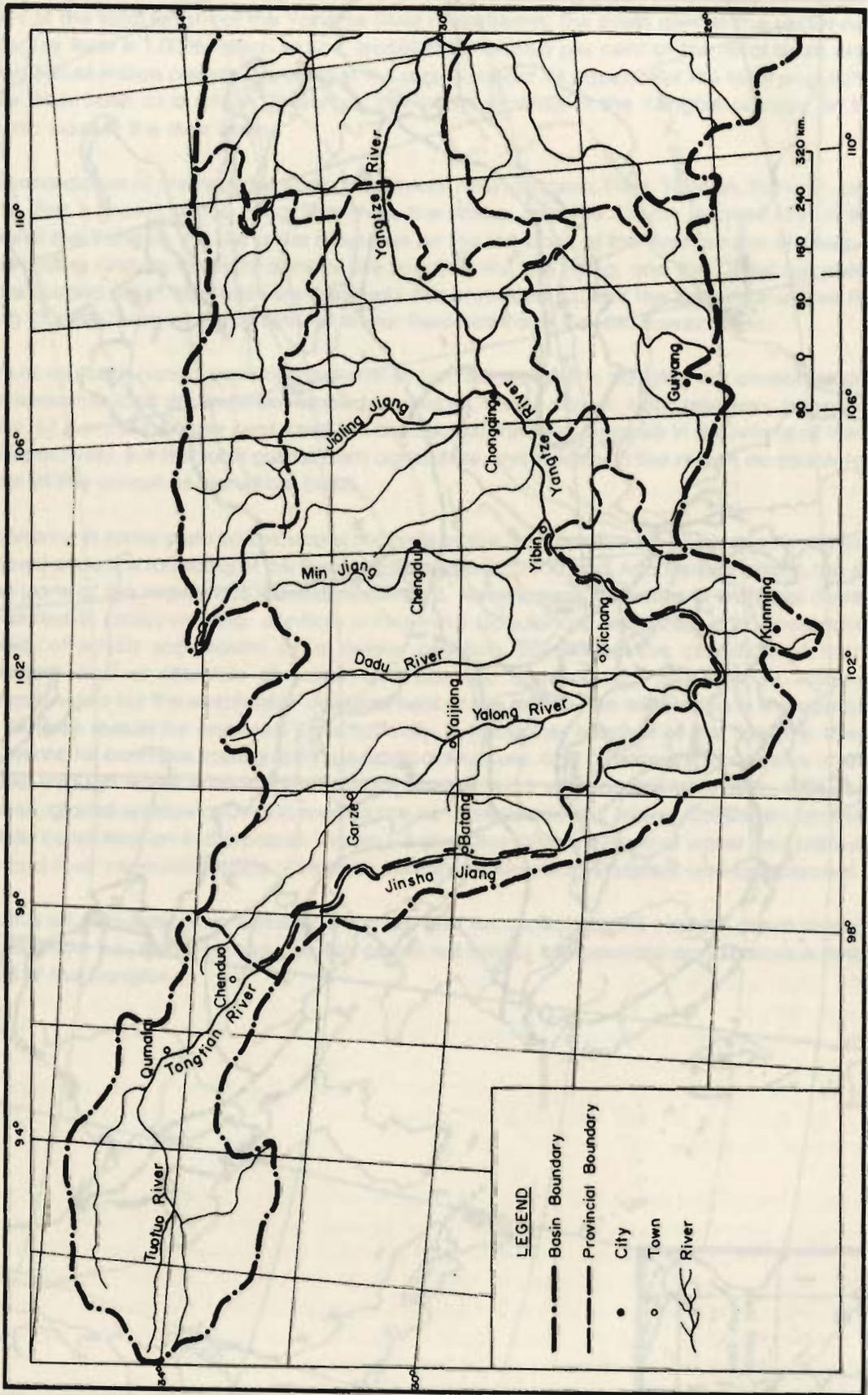
In China a lot of research on water and soil loss and on aspects of soil erosion, gravitational erosion, and debris flow has been carried out. This paper will mainly concentrate on soil erosion in the upper reaches of the Yangtze.

Figure 1.1: The Course of the Yangtze River



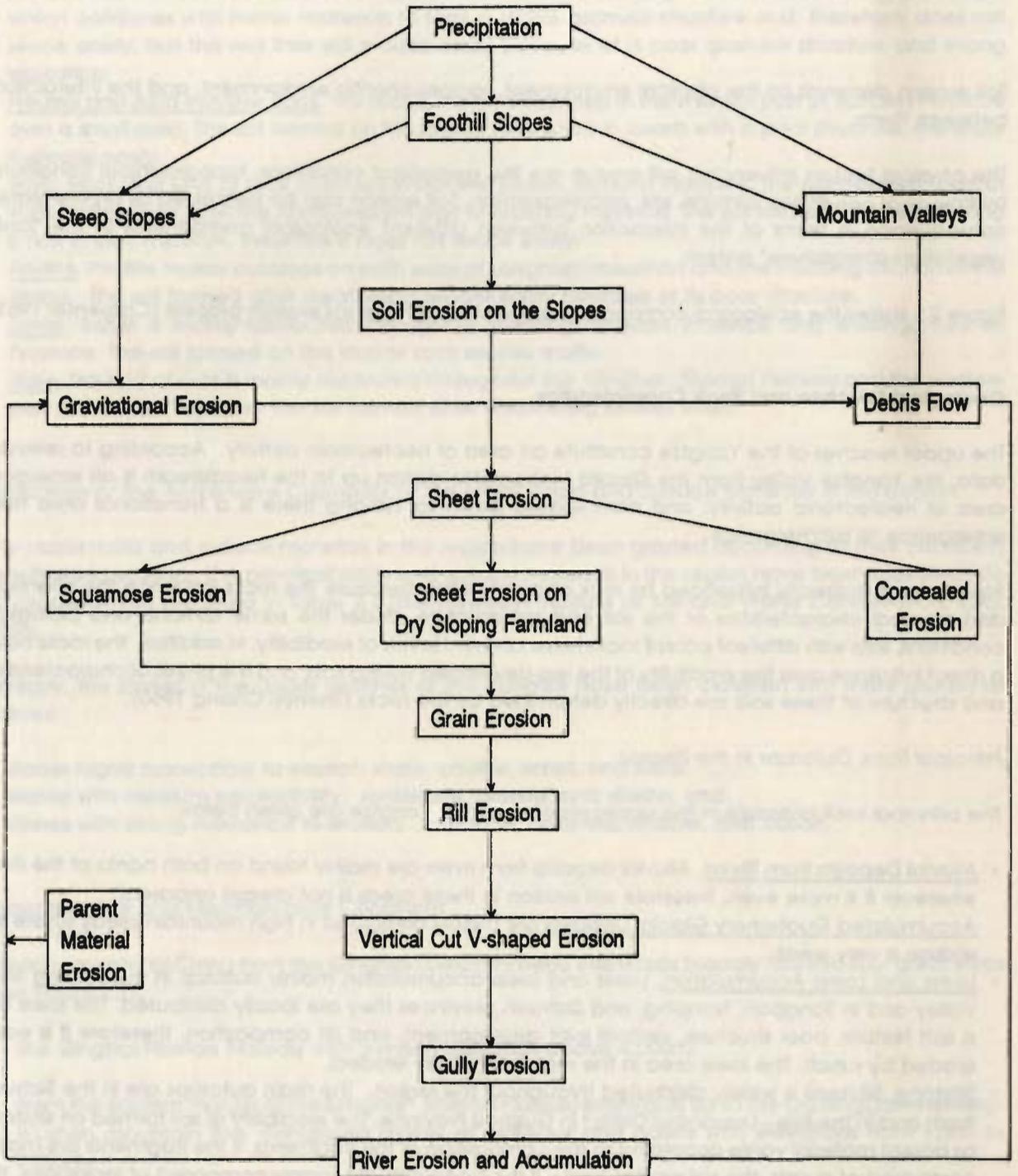
Source: Editing Commission for the "Physical Geography of China", 1981

Figure 1.2: The Upper Reaches of the Yangtze River



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

Figure 1.3: Different Types of Water and Soil Loss and Their Interrelationships



Source: Chengdu Institute of Mountain Disasters and Environment 1988