Debris Flow Studies and Mitigation Strategies in China

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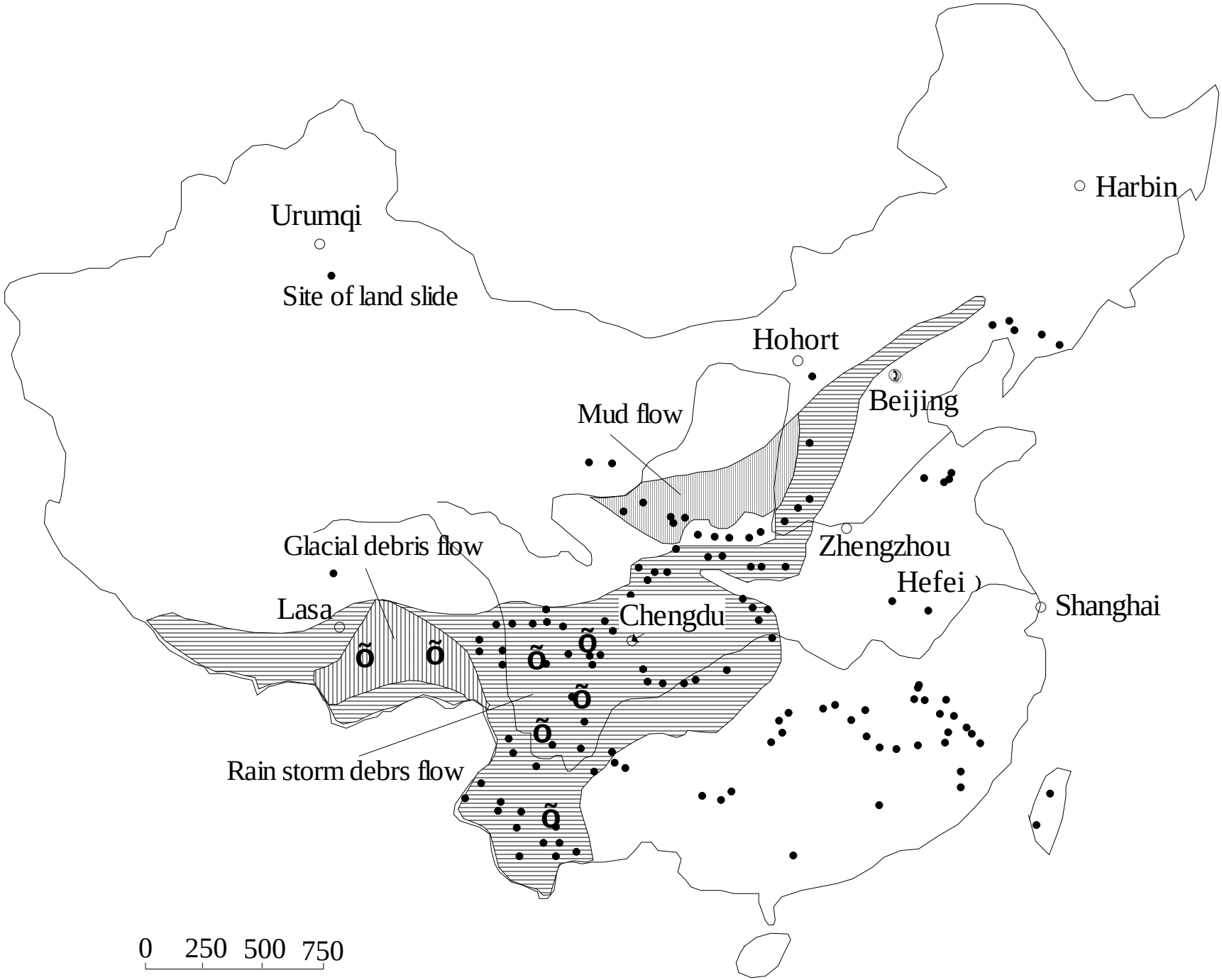
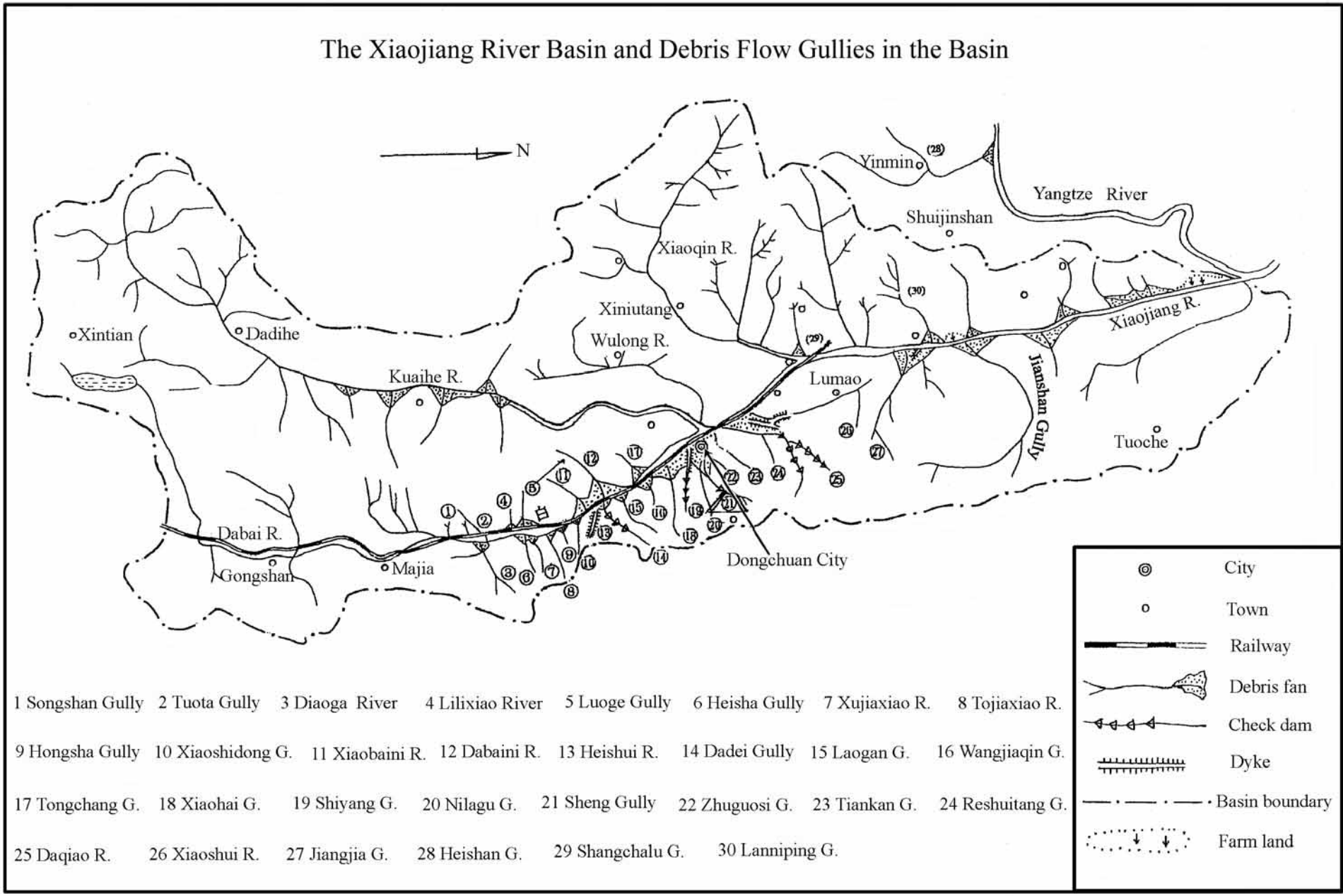
1. Distribution of Debris Flow in China and Debris Flow Disasters

Distribution of debris flow

- Mainly in Sichuan,Yunnan,Tibet.
- 800 counties (40%) witnessed debris flow
- 60 towns were damaged
- 10000 debris flow gullies
- Rainfall debris flow in Sichuan,Yunnan, Gansu
- Glacial debris flow in Qinghai-Tibet plateau
- Mud flow in loess plateau


Harbin
Urumqi
Site of land slide
Hohort
Beijing
Mud flow
Glacial debris flow
Zhengzhou
Hefei
Shanghai
Lasa
Chengdu
Rain storm debrs flow
0 250 500 750



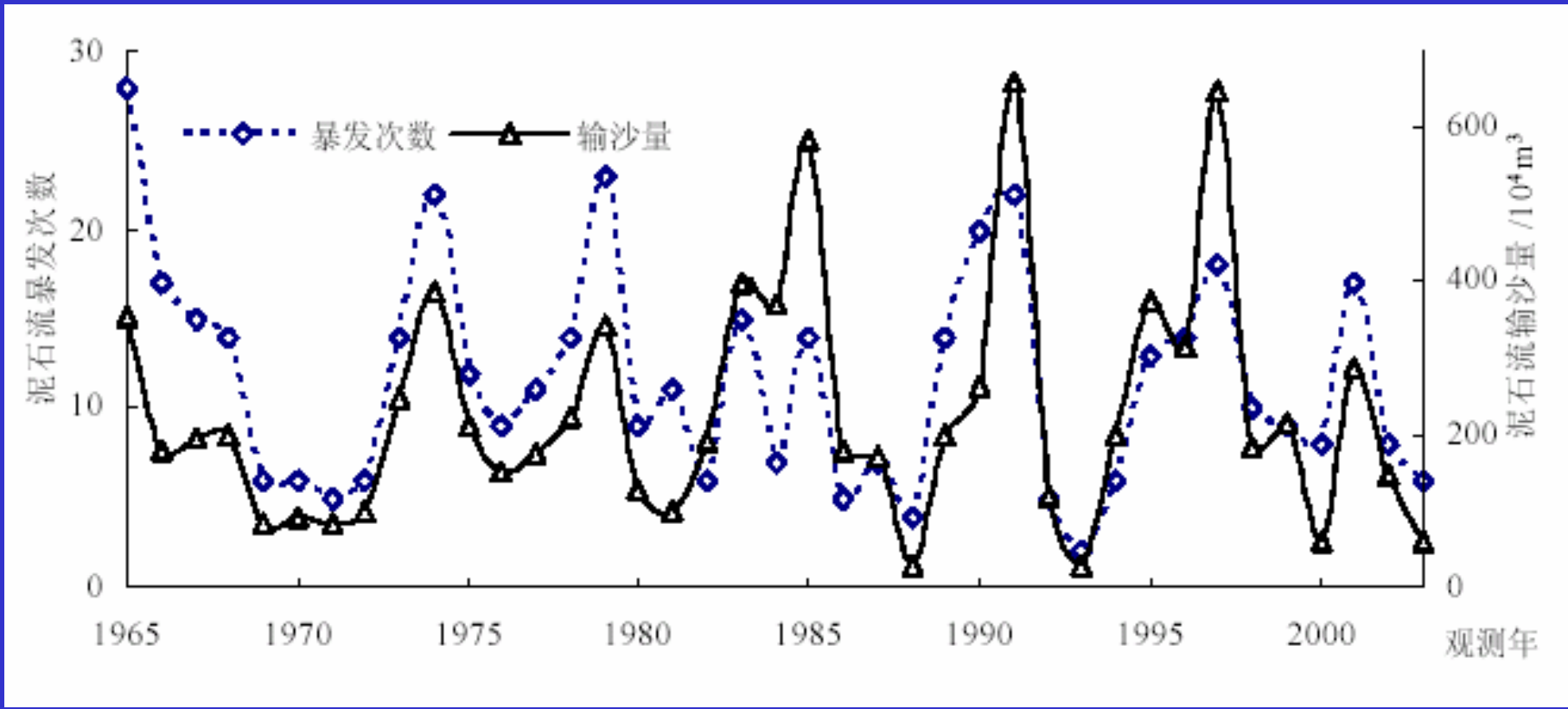
The Xiaojiang River basin and 107 debris flow gullies. Most of the eroded sediment deposited and stored in the basin

强烈地质应力使岩层扭曲变形 Geological forces tortured the rock

Periodicity

- Very active debris flows: 50-60 years
- Active debris flow: 11 years and 22 years
- 1960 and 1980 are active periods (1981)
- 1981 - Tibet, Sichuan, Gansu, Shaanxi, Liaoning, and Jilin.
- Jiangjia Ravine-5-7 years period
- Sichuan 61 counties were hit by debris flow

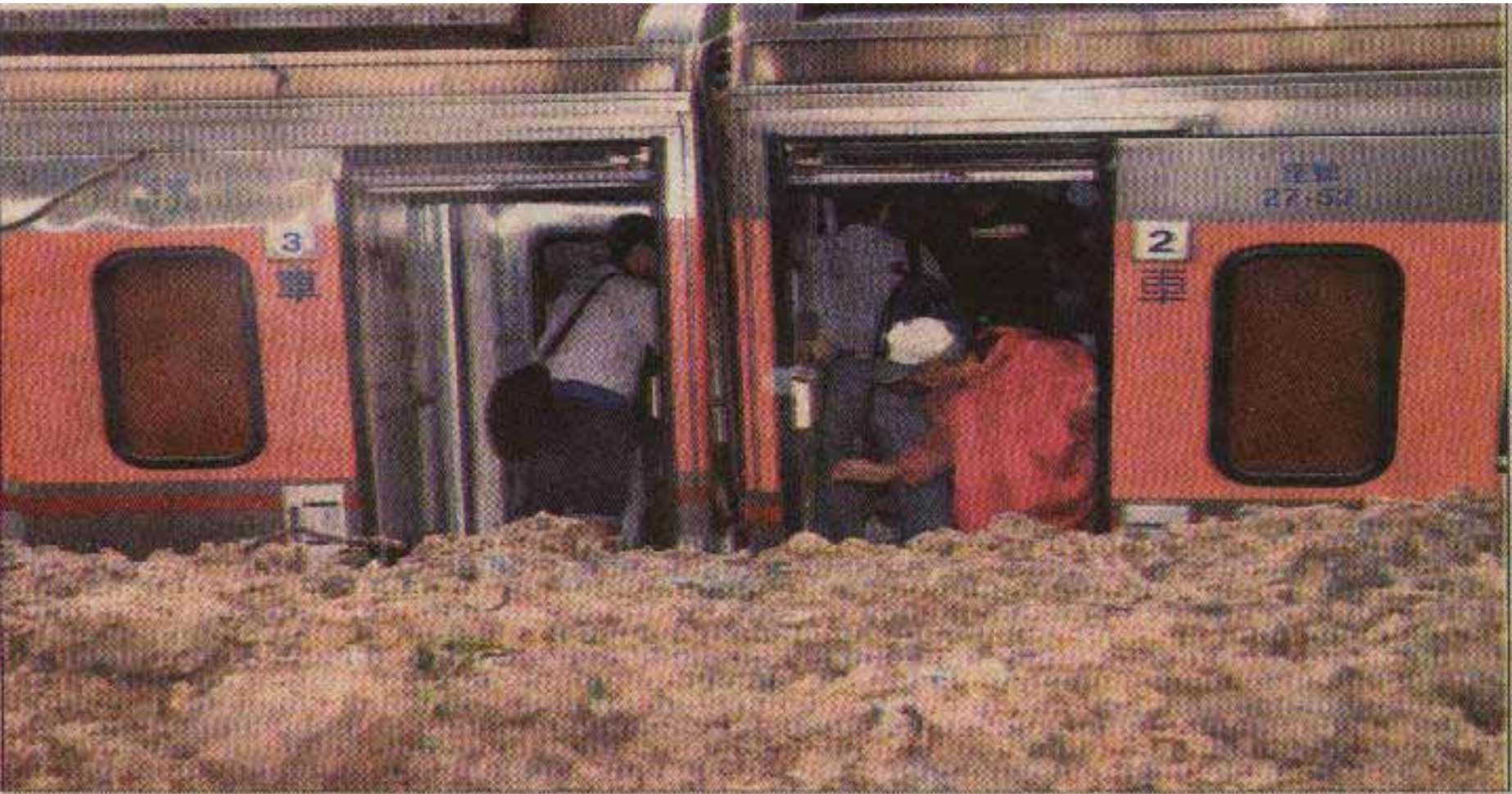
A great volume of sediment is transported into the river by debris flows



The relationship between the annual sediment transport volume from the Jiangjia Ravine into the Xiaojiang River and the annual number of debris flow events in the period 1965~2003

Debris flow disasters

- Damage railways and highways
- 100 cities and towns were invaded and buried
- Barred river channel
- Changed river regimes
- Cause reservoir sedimentation and block bridges
- Detrimental to the environment



驚驚驚

▲在苗栗路段受阻的自強號列車，擋進五、六百立方公尺坍方土石中，車門幾乎被土堆阻擋乘客上下困難。（陳慶居攝）

▶司機員吳志成被救出駕駛室送醫，山線南北雙向中斷。（陳慶居攝）

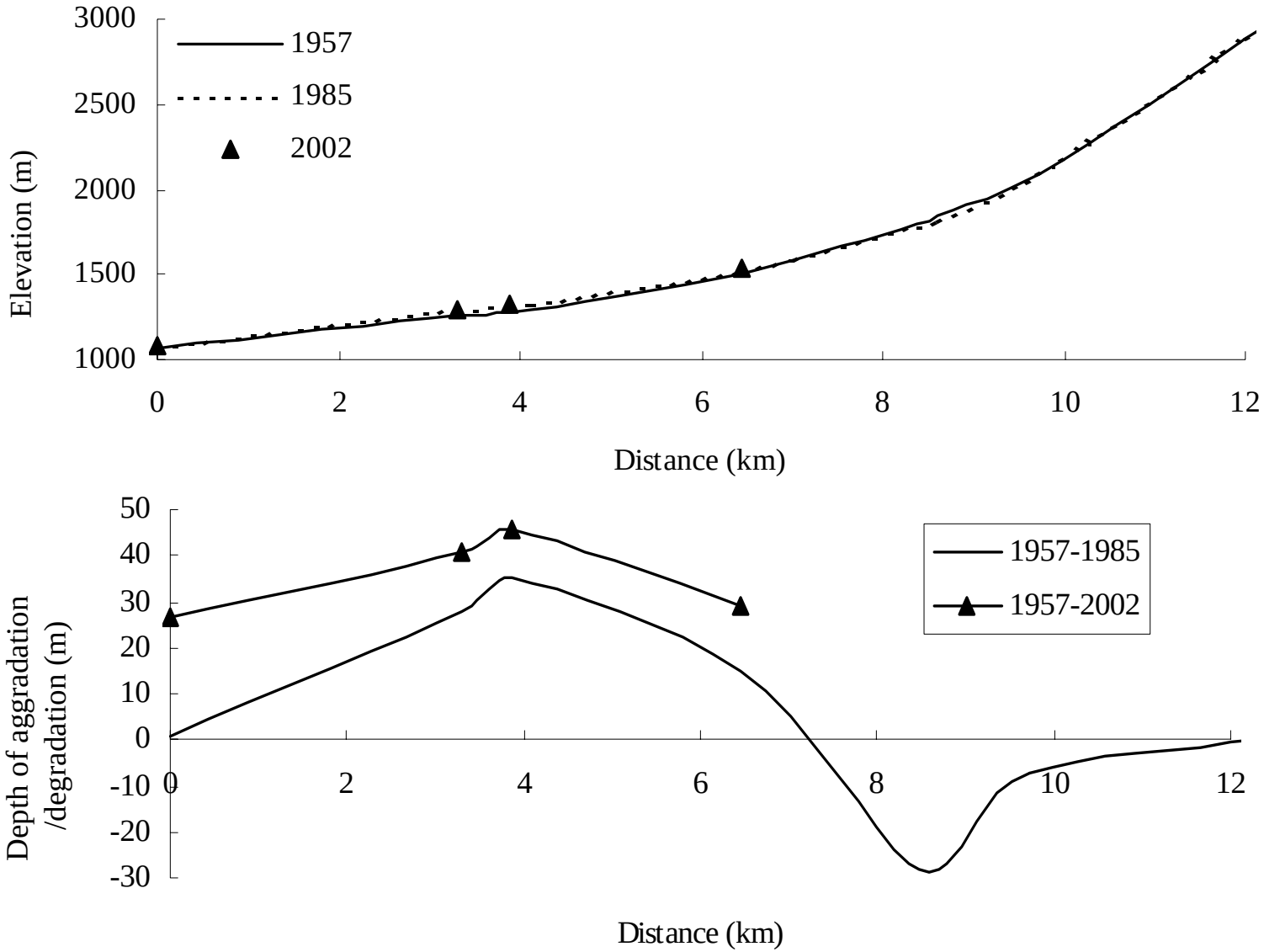
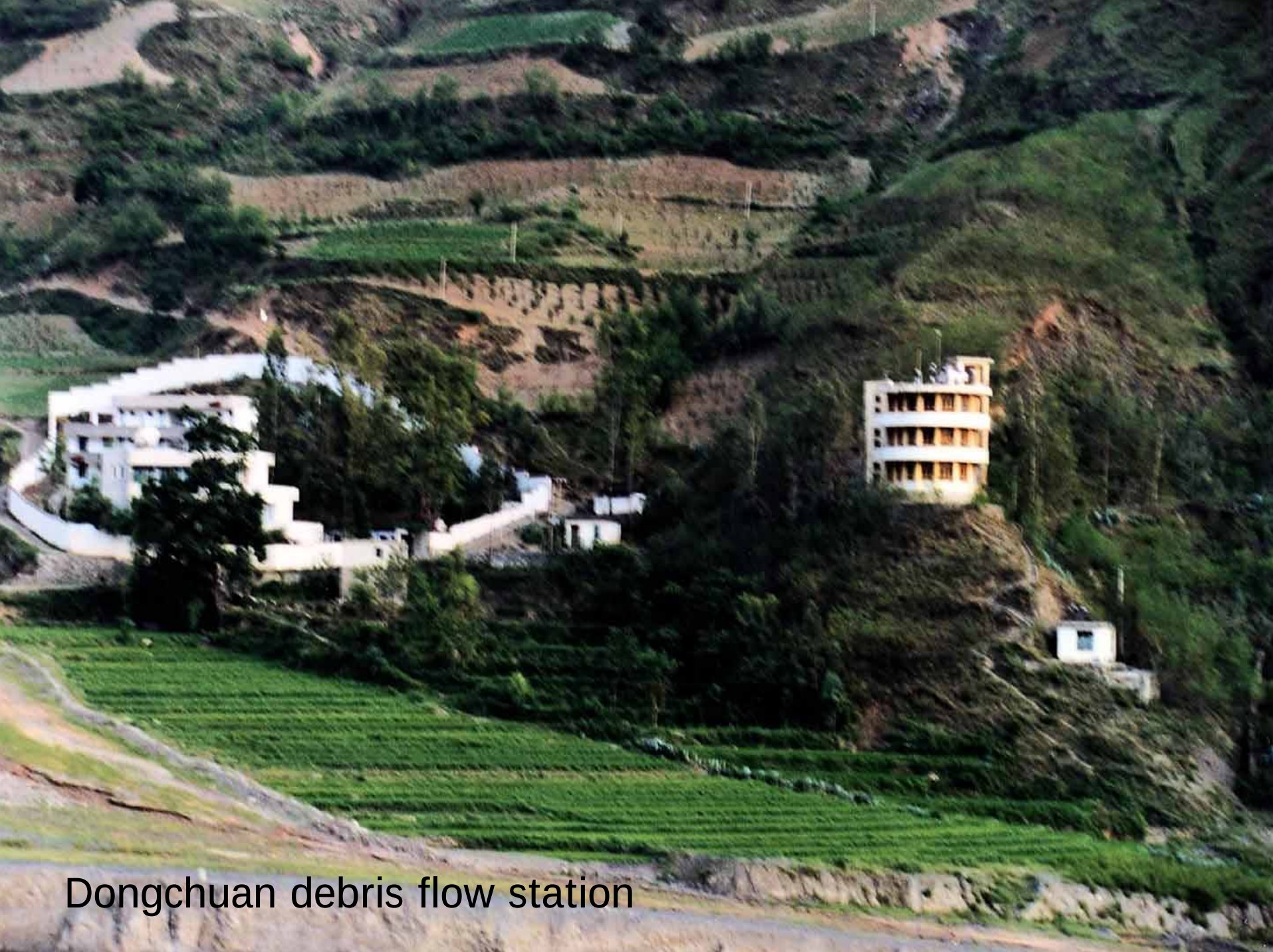


Fig. 7 (a) Longitudinal profiles of the Jiangjia Ravine in 1957, 1985 and 2002; and (b) Aggradation and degradation of the Jiangjia Ravine in the periods 1957-1985 and 1957-2002.



Dongchuan debris flow station

Debris flow on Banpo gully reduced flow section of Yalong river (1990)

盐源县干街乡半坡泥石流 9311

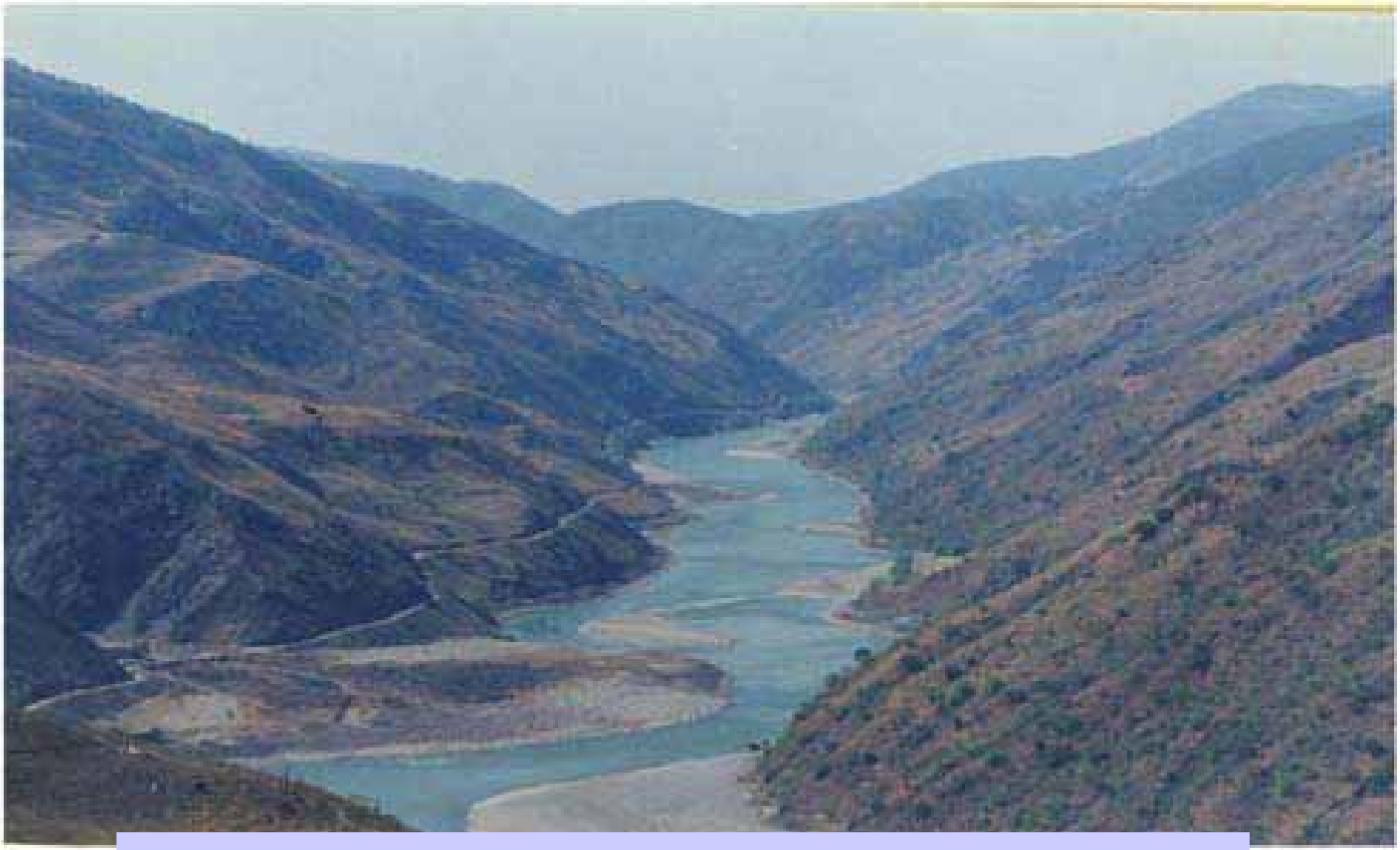
Xiaojing River was blocked by debris flow in Dabainin Gully in 1997


小江
Xiaojiang River
金沙江
Jinsha River

A barrier lake on Bailong River caused by debris flow in 1992

Table 3 River channel aggradation in debris flow areas

River name	Xiaojiang	Dayingjiang	Bailongjiang	Beiyuhe	Xikouhe
Location	Yunnan	Yunnan	Gansu	Gansu	Sichuan
Channel accretion (cm/a)	13 ~ 20	5 ~ 10	5 ~ 16	9	19



Debris flow deposit in the channel reduces the discharge capacity of Yalong River (1990)

Debris flow deposit reduced and affected navigation in Wujiang River