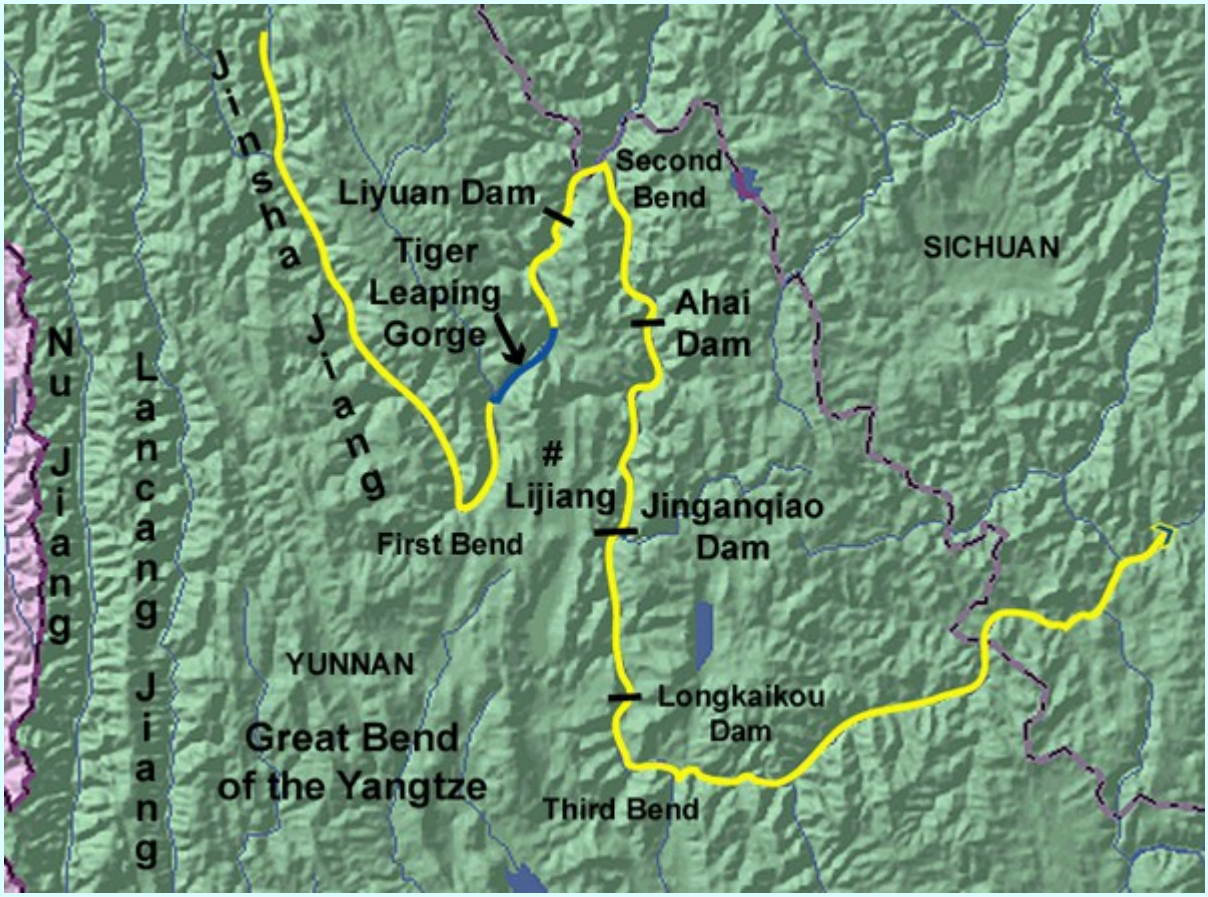
Geology and Geography of the Great Bend of the Yangtze Tiger Leaping Gorge

Tiger Leaping Gorge

In the Great Bend area, the Yangtze is called the Jinsha Jiang, or Gold Sand River. The river flows southeast and south from its source in Qinghai for over 1500 km, along the Sichuan-Tibet and Sichuan-Yunnan borders in the Three Parallel Rivers area (the Yangzte is the easternmost of these rivers), then after passing into Yunnan it makes an abrupt 160 degree (First Bend) and flows about 130 km northeast to its confluence with the Shuiluo River (the source of the gold), then makes another fairly abrupt 160 degree turn (Second Bend) to flow due south for nearly 300 km before turning east across the southern Sichuan Basin (Third Bend).

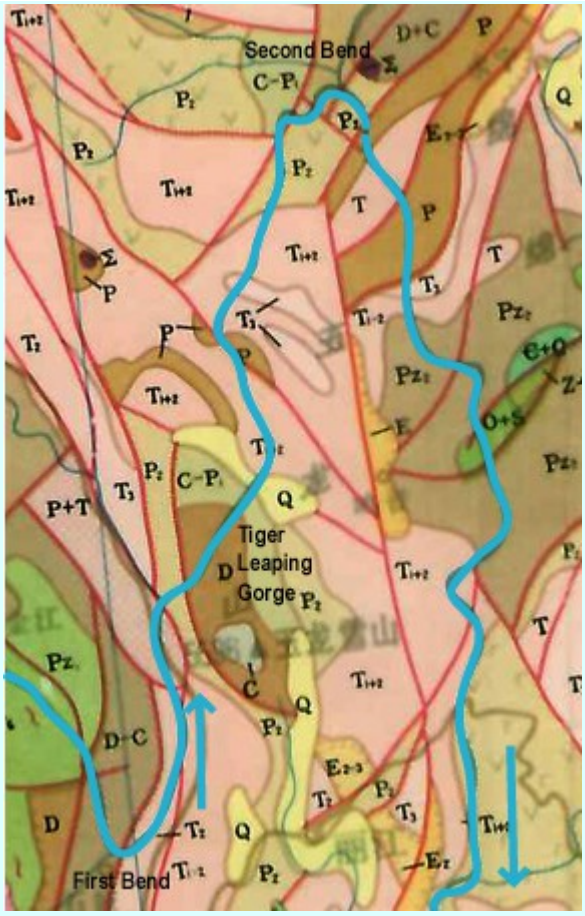


Three Great Bends of the Great Bends, showing dams under construction.
Map by Rand McNally.

First Bend of the Jinsha (file photo)

Second Bend of the Jinsha, Shuiluo confluence on left (photo by Li Hong).

The Great Bend area has a very complicated geologic history. The colors and symbols on the geologic map below represent different rocks types and their ages and the red lines represent major faults (breaks in the earth's crust). Rocks in the Great Bend area are dominated by a series of recrystallized limestones that are 490 to 250 million years old (O+S, D, D+C, and P on the map). The rocks are dated by the fossils they contain. Continental siltstones and sandstones that are 200 to 250 mya (T) are present above the limestone layers, and when they are at river level they form wide valleys. All of these rocks are highly deformed. Folded layers from old tectonic events (before the Himalaya Mountains began to form about 40 mya) are common, as are faults associated with uplift of the Himalaya Mountains and Jade Dragon Mountain. Groundwater discharges from some of these faults, producing large, beautiful springs.



Map produced by the Chinese Ministry of Geology and Mineral Resources
Original scale 1:1,000,000

Fossil in Limestone (photo by Li Hong).

Limestone Cobble (photo by Li Hong).

Limestone Beds, with oldest layers at bottom (photo by Li Hong).

Massive Limestone Cliffs (photo by Li Hong).

Sandstone cobble (photo by Li Hong).

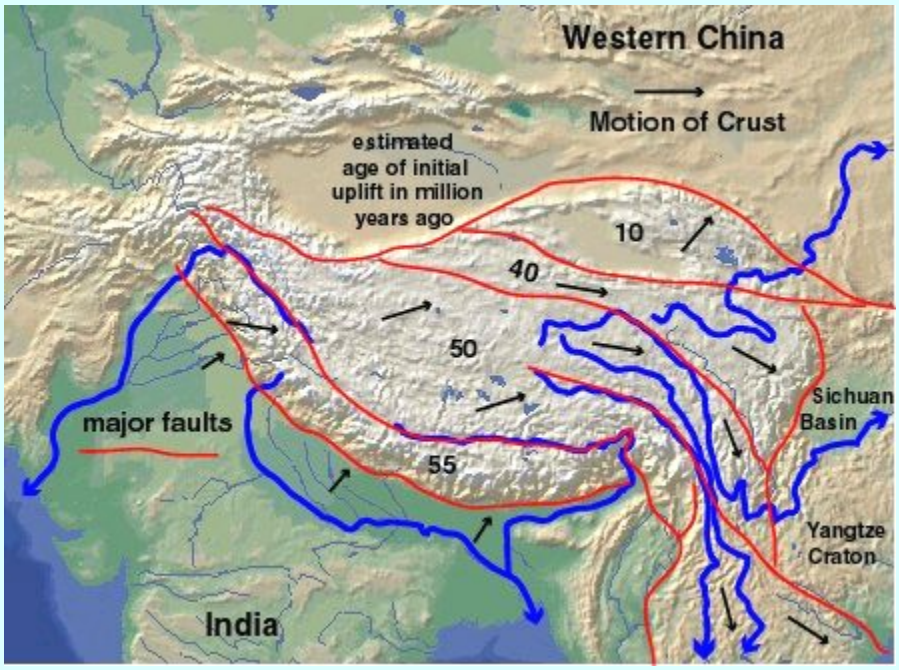

Sandstone Cliffs (photo by Li Hong).

Rock shattered by fault zone activity (photo by Li Hong).

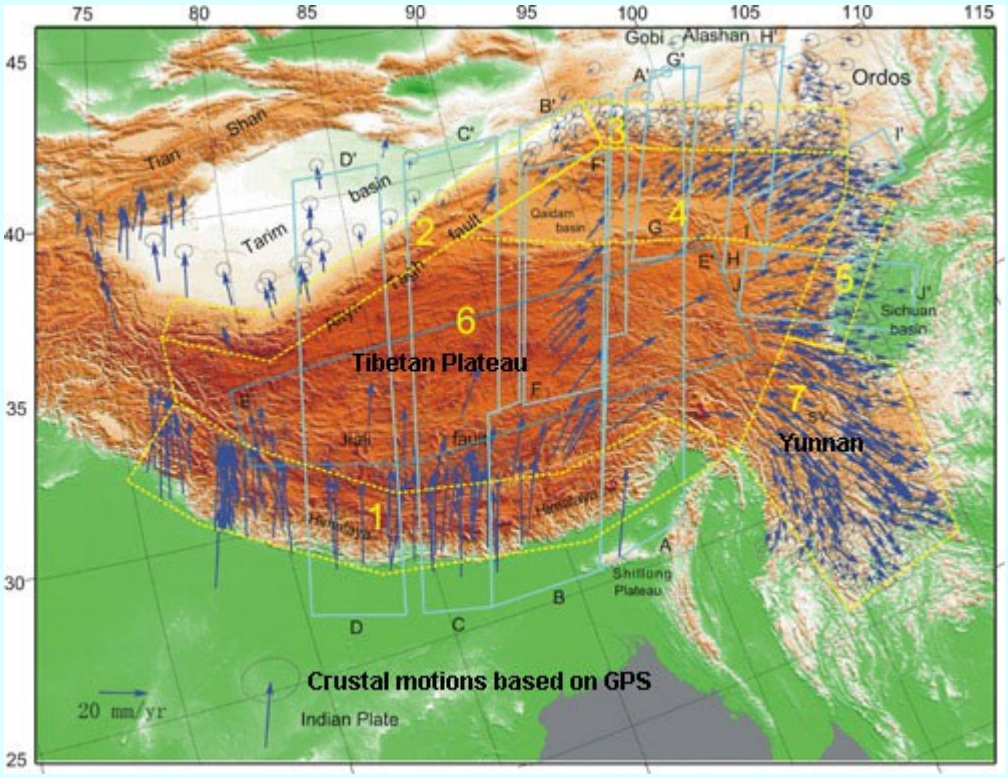
Large Spring in Limestone Canyon (photo by Li Hong).

As a result of India's collision with Tibet during the past 40 million years, large masses of Chinese crustal rocks have been shifted east and southeast, both along major faults (red lines on tectonic map) and throughout the fault blocks (blue arrows on shear map). This motion has also

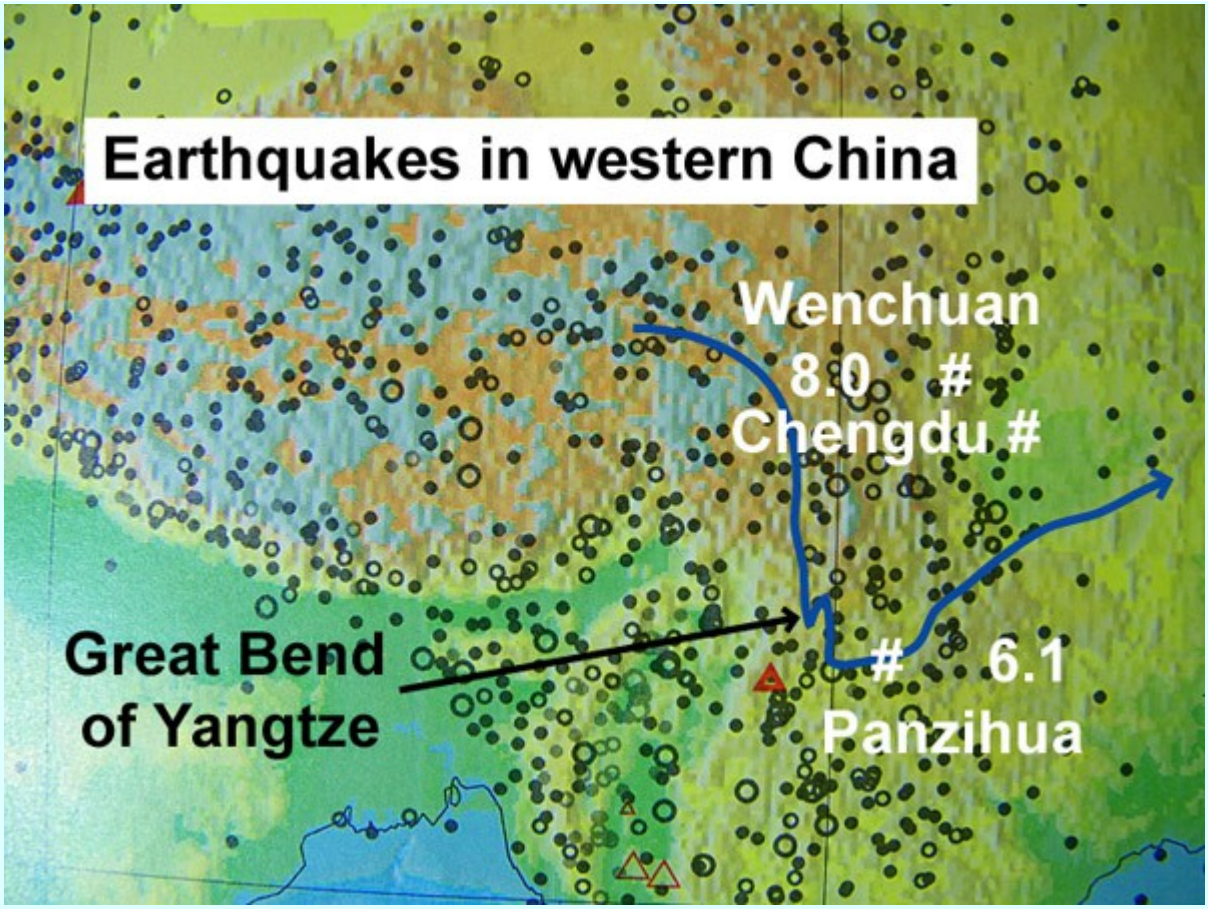
resulted in frequent large earthquakes - western China is the most seismically active area on our planet.



Tectonic map of major fault bounded blocks and their ages (by Clark Burchfiel and others)

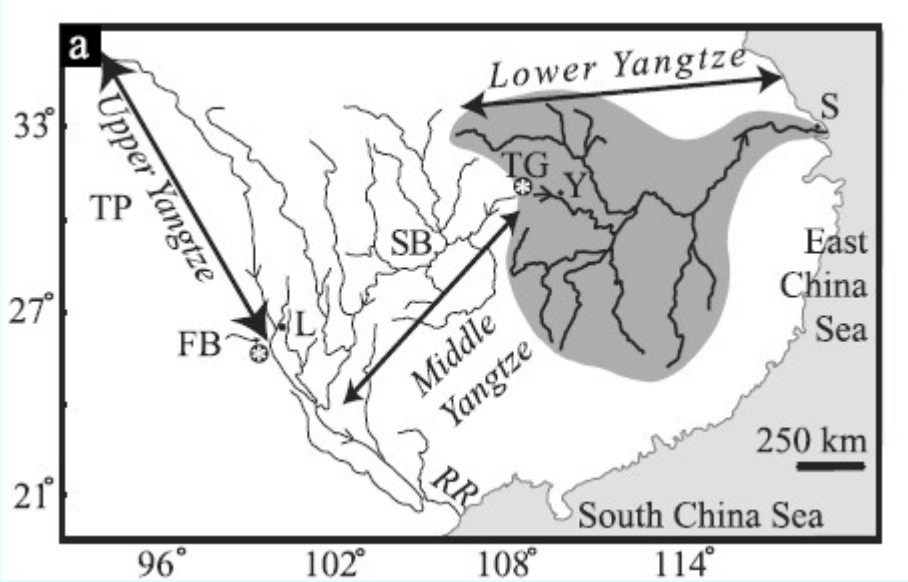


Shear distributed with fault bounded blocks (by Molnar and others).

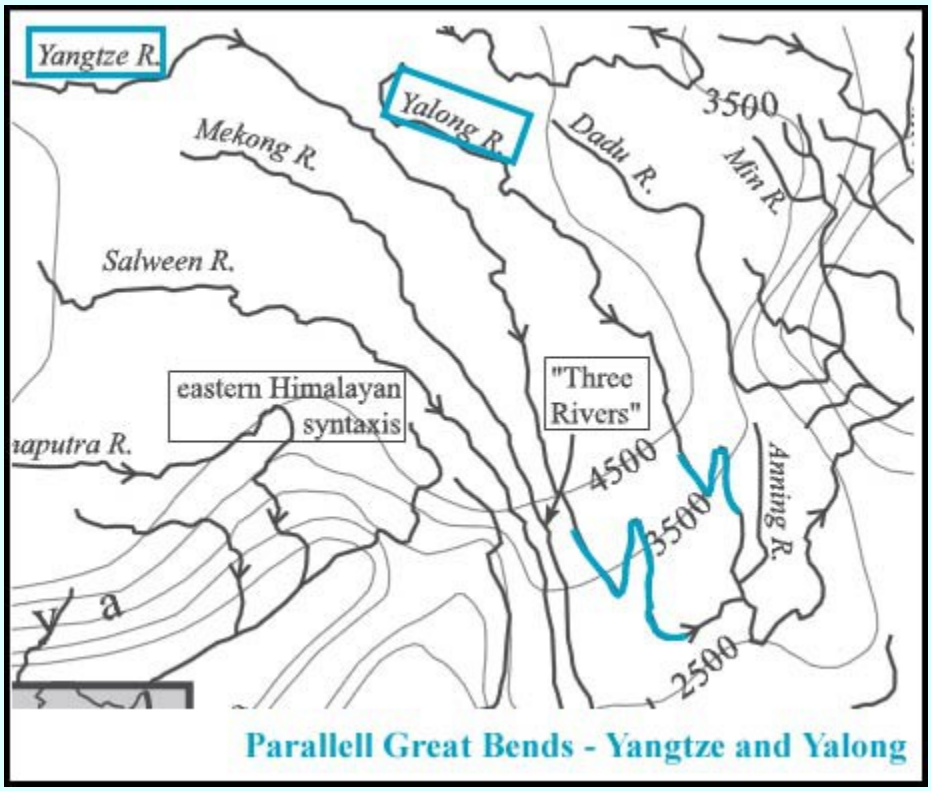


Major earthquakes in western China as of 2008 (US Geological Survey).

Geomorphologists believe that the Yangtze in the current north flowing leg of the Great Bend once flowed south into the Red River south of Xiaguan (at the south end of Lake Er). As the Jade Dragon mountain range began to uplift over the past 10 million years or so, an aggressive tributary to the lower Yangtze captured the river at the current Second Bend, eventually causing the upper Yangtze to flow north through Tiger Leaping Gorge at about the same time that uplift of the Diancang Mountains west of Dali was disrupting the drainage of the Red River. As the Indian continent continued its collision with Tibet and surrounding areas, large fault bounded blocks were subject to regional shear, resulting in the current drainage patterns for the Yangtze and one of its large tributaries, the Yalong Jiang.



Pre-Himalayan Yangtze Drainage Pattern (by Burchfiel and others).



Yangtze and Yalong - Parallel Great Bends (highlighted in blue) (by Burchfiel and others).

As the large ice sheet that covered the Tibetan Plateau beginning about 2 mya began to melt about 12,000 years ago, the river carried more gravel into its canyons than it could carry out. Over the past few thousand years, the river has eroded these gravels, leaving thick well cemented terraces several hundred feet above the river.

Ice Age Terraces perched several hundred feet above the river (photo by Li Hong).

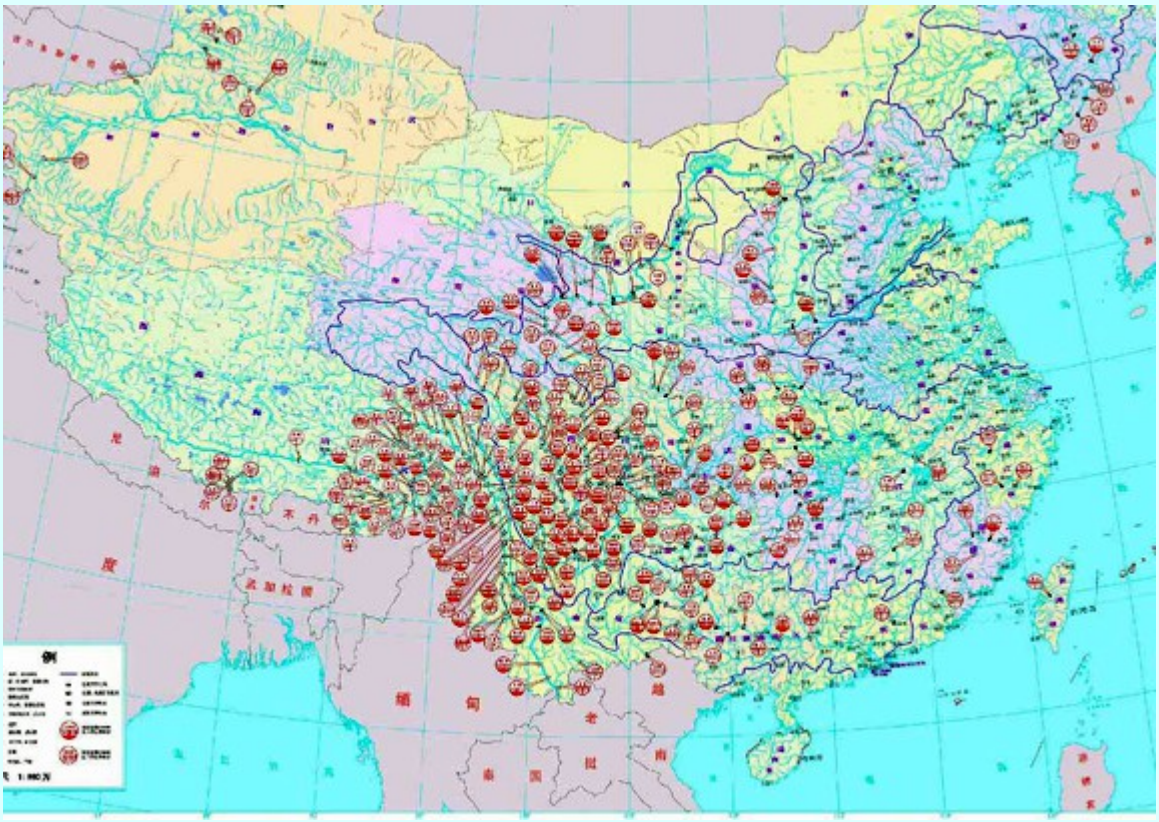
The Yangtze in the Great Bend is a large river and can move huge boulders. Its flood flows exceed 70,000 cubic meters per second. One of the most famous rapids in the world it Hutaio Shoal in Tiger Leaping Gorge. It has only been run once, in 1986, by a Chinese team (Figure 20 - Tiger Leaping Gorge). During these floods, it also carves beautiful patterns in the canyon walls, called "fluting".

"Rafting" Hutaio Shoal in Tiger Leaping Gorge, 1986 (file photo).

Fluted (water carved) limestone (photo by Li Hong).

In response to international pressure to reduce greenhouse gas emissions from coal burning power plants, China has embarked on a major nationwide program of building hydropower dams. The most famous of these is the Three Gorges Dam near Wushu. However, most of these dams will be built in western China, where the gradient of the rivers is steep. See the large dam map below: red circles are dams that have been completed, are underconstruction or are planned

to be completed by 2020). The Chinese government needs to conduct a regional study to see if there is enough water for all of them. The United States built too many dams on the Colorado River in the 1950s and 1960s, and now some of their reservoirs are only half full. Western China is also an area with very high seismicity and has numerous large, active faults. There have been over ten large earthquakes in this area in the last century, one of which may have been caused by rapid draining of the Xipingpu reservoir near Wenchuan. One can only hope that a large earthquake will not cause the failure of multiple dams.



Map of Large Dams in China, 2008 (from internet).

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More info about rivers in China