A recent paper by Hongfu Yin and Changan Li (2001) of the China University of Geosciences in Wuhan, China, has highlighted the possible influences of human intervention on flood disasters associated with the middle Yangtze River.

The entire Yangtze drainage basin was subjected to a major flood event in 1998. This flood was considered to be the largest since 1954, had a peak high water level duration of 70 days and the event was associated with a strong El Nino event during June and August of that year. Up to 4,100 people were killed (www.bbc.co.uk, August 5 1999) and over 250 million people affected by the flood event (www.cnn.com, August 25 1998). The total direct loss was calculated at US$20 billion. The floods, which occur almost every summer, affected a wide area as shown in Figure 1 below.

![Figure 1. The extent of flood affected areas during the 1998 summer floods on the Yangtze River in China (Source: www.bbc.co.uk)](http://www.riskfrontiers.com/RFbriefings/notes/issue1/notesDec01article3.htm)

The researchers have proposed that three specific human induced degradation issues have lead to the perceived increase in the frequency and magnitude of flooding in the middle reaches of the Yangtze. These issues are detailed in the following discussion.

**Removal of vegetation and subsequent soil erosion in the upper reaches of the river**

The reduction of the forest cover of the Yangtze drainage area over the 30 years between 1957 and 1986 has been estimated at 50%, and erosion in the same area has doubled in volume. Some authors have argued that there is no relationship between the loss of vegetation and erosion. Cheng et al. (1998) suggested that forested areas do not retain more runoff than un-forested areas for continuous rainfall events. The Chiangjiang Water Resources Commission (CWRC 1999) measured the silt discharge of the middle Yangtze over the
deforestation period of 1957 to 1986 and found little change. However, the authors of this study maintain that deforestation of the catchment area and erosion are 'negative human interventions' as deforestation reduces the seepage loss and retaining capacity of rainfall, which in turn increases the 'rapid convergence of surface water'.

**Reduced water volume of lakes due to reclamation**

Since 1949, the total area of lakes in the middle and lower Yangtze has been reduced by 10,000km² (approximately one third) due to reclamation for cropland. The corresponding reduction in reservoir volume has been in excess of 50 billion m³. The reclamation of these lakes for cropland has reduced the efficiency of the basin to store floodwater and is thought by the authors to be an influence on the increase in flood magnitude and frequency on the middle Yangtze.

**Channel Capacity Restriction due to Levee Construction**

The Chanjiang-Hanshui Basin contains approximately 80% of the surface water drainage of the Yangtze, and has only one narrow outlet. Prior to the 1548 construction of the Great Jingjiang Levee, the middle reaches of the Yangtze were comprised of semi-parallel river branches over the entire basin area subsequently depositing materials and forming the flood plain. The levee was constructed on the northern branch of the river, and in the ensuing centuries since its construction, deposition of silt has predominantly occurred on the southern side of the river only creating a low land swamp on the north side (40% of the total cultivatable land is now water logged). The difference in height between the northern and southern banks is in the order of several metres. This has resulted in a rise in flood levels and, correspondingly, the discharge ability of the Yangtze is decreasing. The 1998 flood was 13m higher than the levee protected northern plain.

**Strategies and Tactics**

With direct losses in the order of US$20 billion, the authors propose moving away from a 'keeping the flood away' strategy to 'giving the flood away' and support the specific strategies and tactics of Yin and Li (1999) as outlined below:

**Strategies**

- Integrating flood control construction with environmental protection;
- Concurrent regulation of levee consolidation, flood storage and discharge;
- Combined control of the river and lakes, water and sediment;
- Cooperation tackling by national, regional and local administration; and
- High-tech decision-making system on flood control.

**Tactics**

- Soil erosion control in the upper reaches;
- Establishment of flood-diversion areas;
- Consolidation of the main levees along the river (basement and lateral erosion);
- Flood reservoir construction;
- Evacuation of discharge channels; and
- Planned silt discharge and drainage of water-logged areas.

Further flooding occurred during the summer of 1999 and levels were approximately half that reached during the 1998 event. Flood control measures implemented between the two flood events have been estimated at US$7.2 billion, which approximately US$80 million spent on levees in Wuhan (www.bbc.co.uk, August 5 1999).

**References**

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