

Spatial and Temporal Distribution of the Lower Yellow River Dike Breaches in Qing Dynasty (1644-1855)

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Abstract: The Yellow River plays an important role in Chinese Culture, just like the Ganges in Indian Culture, the Euphrates and Tigris in the Ancient Babylon, the Nile in the Ancient Egyptian and the Mediterranean in the Ancient Greek. This research aims to clarify the Yellow River's flood locations, and try to reveal the rule of the Lower Yellow River dike breaches during the Qing Dynasty. This research aims to clarify the locations where the Yellow River flooded, and determine the rule of the Lower Yellow River dike breaches during the Qing Dynasty. Most of the Upper Yellow River flows into the mountain area, which means the river is more stable. As the Lower Yellow River flows into plains area, the slope becomes gentle. Since there is no terrain blocking, the river siltation and the river route changed very frequently during these thousands of years. After a project in the Ming Dynasty on the Yellow River by Pan Jixun (潘季驯) strengthened the downstream river dredge and control, the river became much more stable. This has made possible the study of the locations where the Yellow River floods. Deposition of silt in the river plains of the Yellow River is significantly higher than both sides, so it is possible to use the DEM elevation data for the river restoration of the Yellow River. Based on these two premises, this research selects the records of the Lower Yellow River dike breaches from 1644 to 1855, combined with the characteristics of the flood control system of the Qing Government, trying to use not only the statistical analysis method, but also the geographical one. It locates the dike breaches to geographic space, and then analyzes its temporal and spatial distribution.

Keywords: Yellow River, Qing Dynasty, Xun, Dike breaches

Restoration ideas of Dike breaches

As Qing Dynasty was not so far from nowadays, many different literatures were well kept. This research focused on *Records on Waterway in Draft history of the Qing dynasty* (清史稿·河渠志, Juan127), and also using the *Yellow River Chronicle* (黄河志·大事记), in order to comb events of the dike breaches in the main stream of the Yellow River, to determine the timing and location of the dike breaches. The result is a summary list of the locations of the dike breaches. Flood-prevention system of Qing Dynasty has its own unique office of flood control system. That is, the river management branches into the Dao (Director general of the Yellow River), Ting (A functional department of management of the river dikes) and Xun (A management of the river dikes, lower level than Ting), similar to the three-level of province, prefecture, county in CHGIS. The specific locations of dike breaches in historical records tend to be wide-ranging. In order to unify the all the accurate position, this research take "Xun" as the indicator of the dike breaches on the space, which means every event of dike breaches can be located to each "garrison areas"(汛地). Each "garrison area" manages a length of dike with "linear" feature, named as "Xun-Line".

Determining the position of the Xun can provide special foundation for the position of dike breaches. Zhou Fu(周馥)'s writing "Huanghe Gongduan Wenwubingfu Jilue" (黄河工段文武兵夫记略, Introduction to the functional department of management of the river dikes at all levels) in his analects *Hefang Zazhu Sizhong* (河防杂著四种, Four Miscellaneous Works on River Building) in Qing Dynasty, recorded Xun directory of offices in the lower reaches of the Yellow River before 1855. A map named "The Yellow River embankment map for six provinces" (六省黄河埽坝河道全图, 1824-1825, Library of Congress) marked boundary line of Xun and boundary of Ting before 1855 in the lower reaches of Yellow River. With the help of these records, we can recover the approximate location of boundary line of Xun on the point layer. By connecting each boundary line, the recovery of Xun-Line will be possible (as to the small river bend, the broken line will be used). Therefore, based on the above two kinds of data information, we can recover locations of each Xun-Line in lower reaches of Yellow River before 1855.

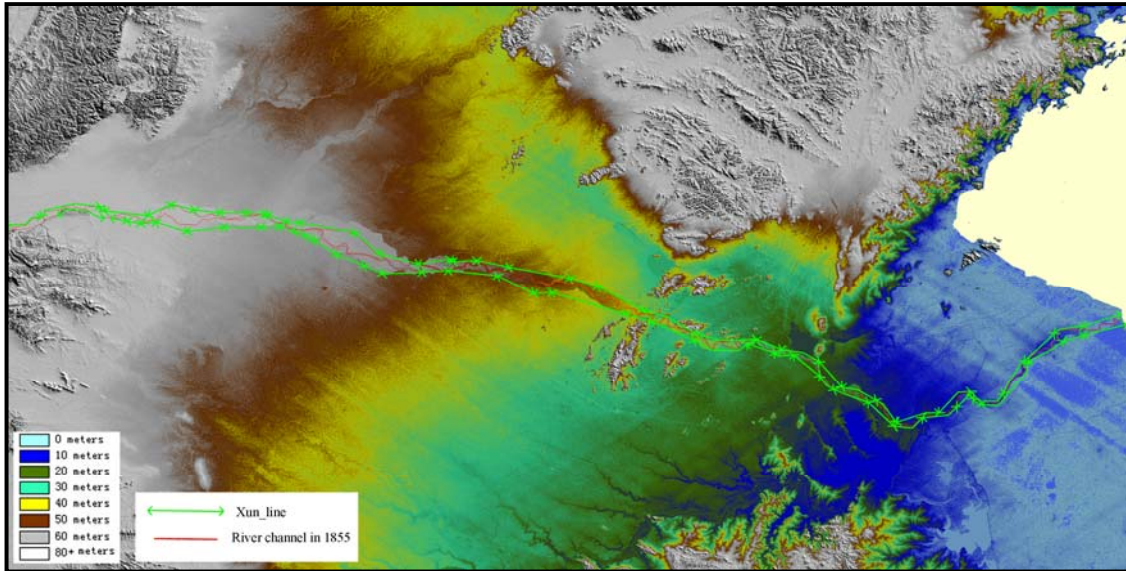


Fig1 Distribution schematic of the lower reaches of Yellow River's Xun-Lines

Afterwards, according to the specific records and local gazetteers of every situation of dike breaches, we can locate the dike breaches to each Xun-Line in the river, and realize the accuracy of special distribution on the

controlling unit of "Xun-Line" scale.

Figure 1 shows the Distribution schematic of the lower reaches of the Yellow River's Xun-Lines on the DEM image (SRTM).

The result of restoration

There were 36 Xun-Lines on the northern bank after Wushe (武陟). Among them, 70 breaches happened in 28 Xun-Lines during 1644-1855. There were 30 breaches between 1644-1676 and 40 breaches between

1677-1855.

Table1 shows the number of the "Xun-Lines" of the dike breaches which took place in on the north bank between 1644-1855.

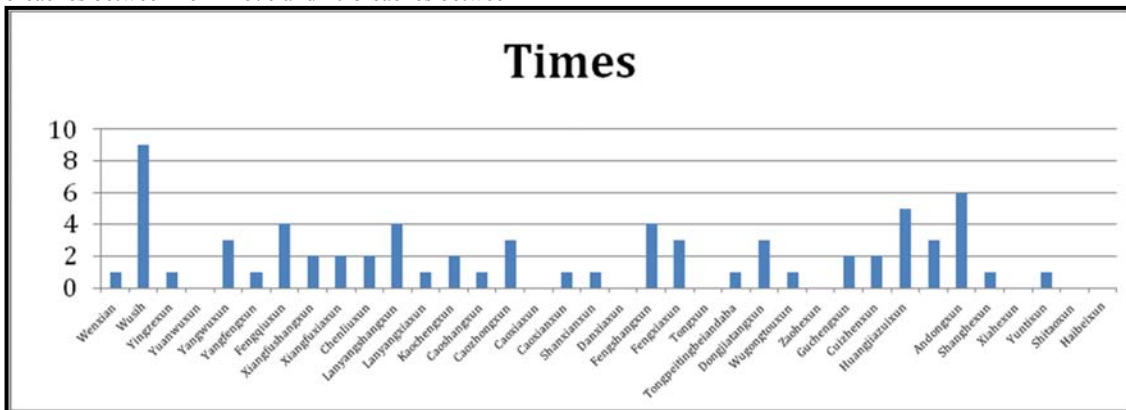


Table1 The statistics of breach times on northern bank.

There were 37 Xun-Lines on the southern bank after Yingze. Among them, 75 breaches happened in 28 Xun-Lines during 1644-1855. There were 25 breaches between 1644-1676 and 50 breaches between 1677-1855.

dike breaches which took place in on the south bank between 1644-1855.

The number of the breaches on the south bank was a little more than the north bank, but the difference isn't very big.

Table2 shows the number of the "Xun-Lines" of the

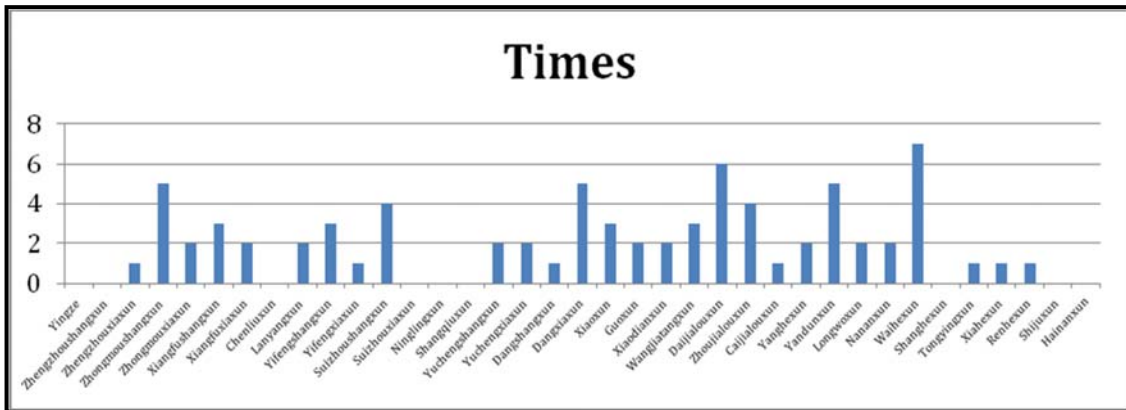


Table2 The statistics of breach times on southern bank.

During 1644-1676, the distribution of breaches in Lower Yellow River covered a wide range. Almost all the Xun-Lines which had crevassed, and the number of breaches had climbed to the peak--7 times--in the year of 1676. During the 33 years, there were 55 records of crevasses, 12 years of which had no breach

records. In the years which recorded breaches, the average times of crevasse were 2.6 times a year, this value may indicate the severity of the breach each flood year. In sum, the average times of crevasse were 1.67 times a year, this value may indicate the severity of the breach of the time period.

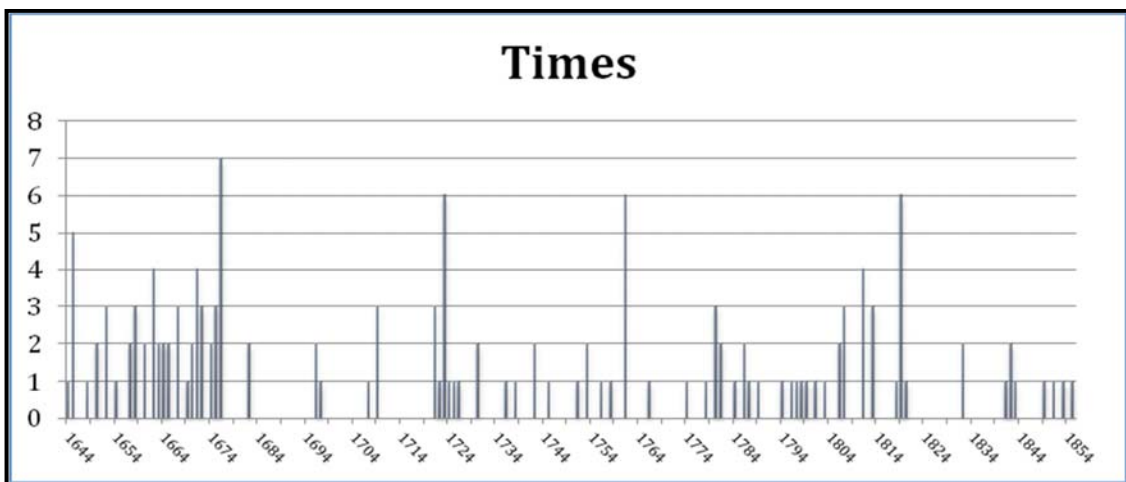


Table3 The annual number of dike breaches

Table3 shows that the annual number of dike breaches on both sides of the Yellowriver banks.

1677-1720: in these 44 years, there were 9 records of breaches. Only 5 years had records of breaches. The average times of crevasse was 1.8 times a year among 5 years. In sum, the average times of crevasse was 0.2 times a year among 44 years.

1721-1766: in these 46 years, there were 32 records of breaches. 17 years had records of breaches. The average was 1.88 times a year among 17 years. In sum, the average was 0.7 times a year.

1767-1820: in these 54 years, there were 39 records of breaches. 22 years had records of breaches. The average was 1.77 times a year among 22 years. In sum, the average was 0.72 times a year.

1821-1855: in these 35 years, there were 10 records of breaches. 8 years had records of breaches. The average was 1.25 times a year among 8 years. In sum, the average was 0.29 times a year.

Figure 2 shows the distribution of the dike breaches in the five time periods.

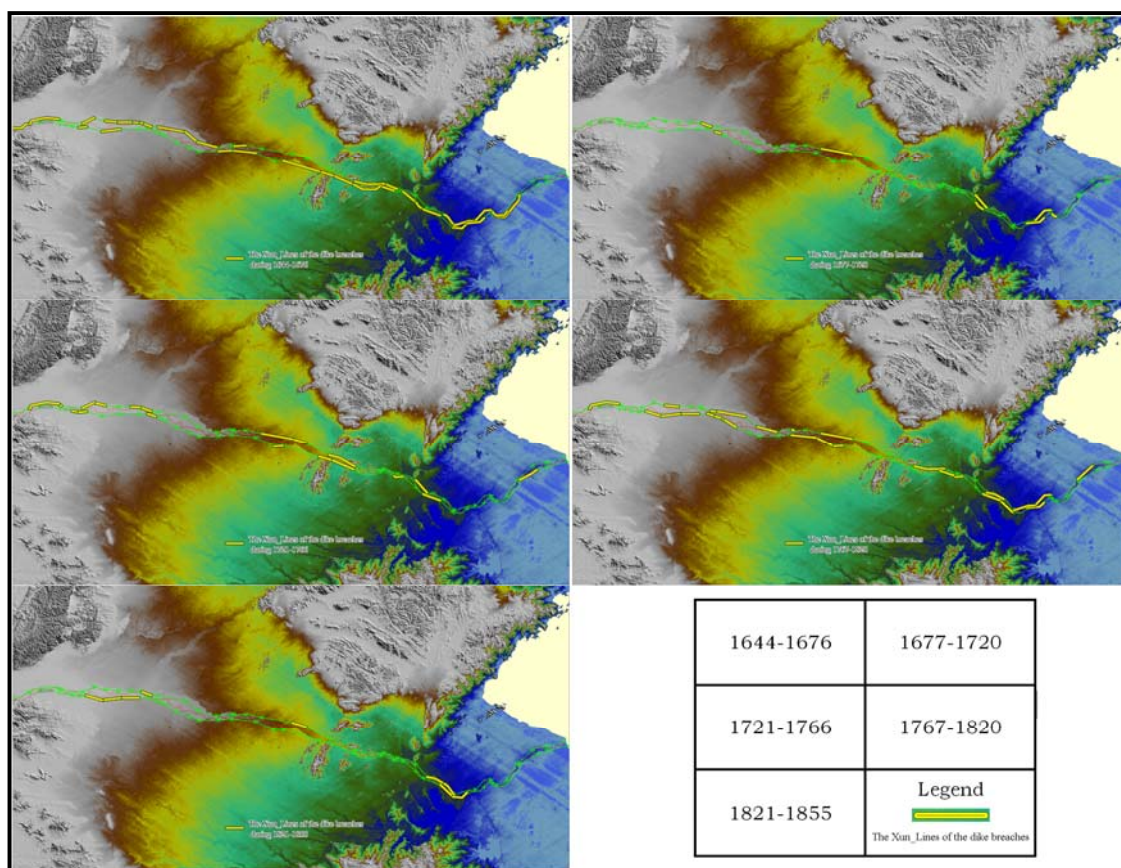


Fig2 the distribution of the Breaches in different period

Discussion

"Spatial and Temporal Distribution of the Lower Yellow River Dike Breaches in Qing Dynasty" directly shows the two-factors of distribution of dike breaches: location and time. From the perspective of time distribution, it can describe the effectiveness and continuity of the management of main stream of the Yellow River in different period in Qing Dynasty. During the early Qing Dynasty, 1644-1676, the flooding of the Yellow River was very serious. From the beginning of 1677, as the Qing government adopted Jin Fu (靳辅), Chen Huang (陈潢)'s strategy of River management, southern and northern banks of the Lower Yellow River became relatively stable for a long time. Although the frequency and distribution of the Yellow River dike breaches had grown between 1721-1820, it was far less severe than 1644 -1676.

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