

Thank you very much for your insightful comments. We have carefully considered your feedback, which helps us a lot to improve the work. We hope that our replies and additional information will address your concerns and contribute to a more comprehensive understanding of the issues discussed in our study. Please find the detailed response below. Referee's comments (RC) are marked in bold font, while authors' replies (AC) are in regular font. All line numbers mentioned correspond to the preprint version. Thanks again!

1/ General questions:

Insofar as famine does not affect all regions at the same time, aren't subsistence crises partly “exchange-soluble”? In other words, are there attempts (by local or central government, farmers...) to alleviate famines - on a large or small scale - through massive imports from other regions, through trade between upstream and downstream regions, or through smuggling? Similarly, is there any legislation against trade in times of crisis?

Reply: Regional interaction plays a crucial role in addressing famine. However, during 1627-1644, regional interaction mainly manifested through the form of human migration, wherein victims fled their hometowns and migrated to surrounding areas in search of food (measure (5) in Table 6).

As for the transfer of grain, there are a few documented instances, such as in Ankang County, Shaanxi Province, where "Liu Yingke returned with rice from Hubei Province by boat and dispersed it (刘盈科自楚贩米归, 倾舟散之)". However, such records are rare. Conversely, numerous records said 'no place to buy grain (无余处)', suggesting that even those with financial means could not procure grain from other areas.

Several factors contributed to this situation: (1) The study period coincided with the end of the Ming Dynasty, characterized by a widespread shortage of grain storage across the country. Additionally, the central government's diminished governance capacity hindered long-distance food transportation on a national scale. (2) Adjacent regions often suffer from droughts and famines at the same time, especially in the peak phase, making it challenging for them to achieve self-sufficiency, let alone assist neighboring regions. (3) The Chongzhen period was marked by social unrest, with numerous peasant uprisings and famine victims turning to banditry. These groups blocked roads and looted food, causing great obstacles to the transport of grain.

Given this situation, the government did not prohibit trade but rather encouraged it. For example, the governor of Shaanxi, Sun Chuanting, ordered soldiers to clear the roads to facilitate rice purchasing and encouraged people to traffic grain to Hanzhong on their own. However, the scale and effect of such measures were limited, and overall, they contributed little to addressing the famine.

References:

- Zhang, D.: A compendium of Chinese meteorological records of the last 3000 years (in Chinese), Phoenix Publishing House, Nanjing, China, 2004.
- Sun, C.: Sun Chuanting's documents: Memorial to the throne on the money and grain of Hanzhong (in Chinese), Zhejiang People's Publishing House, Hangzhou, China, 1983.

Table 6 (line 8) shows food distributions (also mentioned on line 306): do local governments own granaries to prevent food crises (which presupposes purchases and infrastructure) or do they legally take control of the trade and grain stored by rural communities?

Reply: Measures (7) to (9) in Table 6 were essentially to distribute grain to famine victims. These grains were predominantly sourced from warehousing storage, which in the Ming Dynasty included various types such as disaster-preparing granaries (预备仓), price-stabilizing granaries (常平仓), community granaries (社仓), and charity granaries (义仓). The first two types were constructed and managed by local governments, while the latter two were established and operated by civilian groups, with the government playing a supervisory role. The grain stored in these facilities was sourced from agricultural taxes, grain purchased in bountiful years, and criminal fines.

In addition to warehousing, donations played a significant role, as officials and wealthy gentry contributed money or grain during disaster years, which was then used for distributing porridge, stabilizing grain prices, or providing direct relief. Given the crucial role of donations during Chongzhen Drought, we will include it in Table 6 as measure (10), as follows:

Table 1: Response measures in the Yangtze-Huai Region from 1627 to 1644

	Response Measure	Main Actor	Meaning
(7)	Giving porridge	Local government, officials, gentries	Open porridge factories to feed famine victims
(8)	Selling grain at low price	Local government, gentries	Sell stored grain at low prices to prevent excessive increases in grain prices on the market due to shortages.
(9)	Financial or food relief	Local government, central government	Distribute food or money to the victims directly.
(10)	Donation	Officials, gentries	Donate money or grain to support measures (7)~(9).

References:

- Chen, G.: Research on the warehouse system and famine preparation in the Ming Dynasty (in Chinese), Seeker, (5), 1991.
- Ju, M., and Yi, L.: The change and new understanding of ever-normal granary in the Ming Dynasty (in Chinese with English abstract). Journal of Henan Normal University (Philosophy & Social Sciences), 49(5), 129-135, 2022.

2/ Specific questions:

In table 6, line 15, “Praying for rain”: is this a political and religious initiative, or just an individual and local one? Are there any general incentives that might underline the level of social stress?

Reply: The records of praying for rain identify three types of actors: (1) the Emperor, for example, "In the summer (of 1633), there was a severe drought. The Emperor pardoned prisoners and prayed in the southern suburbs, after which heavy rain fell (夏大旱, 清理狱囚, 上步祷南郊, 回銮, 大雨)"; (2) central officials, for example, "On the day of Gui Si in the fourth month (of 1628), the Emperor ordered the Ministry of Rites to pray for rain (四月癸巳, 谕礼部祷雨)"; (3) local officials, for example, in Jiangyin County, Jiangsu Province, "There was no rain from the 5th to the 7th months (of 1640). Zhang Sijia, in charge of coastal defense, initiated prayer with his subordinates. Zhang Fenghe, the local education commissioner, also participated in the prayer (夏五月不雨至七月, 海防张嗣嘉率属步祷, 学台张凤翻亦出祷)."

These examples demonstrate that praying for rain was a political act. Influenced by the Confucian theory of "interactions between heaven and mankind", the government intended to show concern for droughts and self-reflection by praying. This practice helped to appease the populace and mitigate tensions to some extent. However, in the case of Chongzhen Drought, the praying records are sparse and lack detailed descriptions of cause and effect, making further analysis difficult.

The authors mentioned “cannibalism” in Table 2 and Table 6 and state at line 317 that “Severe famine swept through the region, and there were even instances of cannibalism.” Are these extreme cases sufficiently well-documented and numerous to be used in the classification scale of famine levels and response measures, or are they local epiphenomena?

Reply: From 1627 to 1644, there were 557 records of "cannibalism", which is a large number. Over 80% of these events took place during the peak phase of drought (1638-1641). Spatially, such events happened over a wide range, but 88% concentrated in the Northwest and Northern Regions.

Cannibalism signifies that the famine has reached an extreme level of severity, reflecting both the extreme scarcity of food and the collapse of ethics and social order. Based on the records, it is evident that cannibalism, as the most extreme form of food substitution, occurred during the study period. The quantity and content of these records support their use as one criterion for classifying famine levels. However, we also believe that such extreme events should be treated with great caution. We only took them as evidence of famine without conducting further specific analyses of themselves.

As RC2 pointed out, important locations mentioned in the text should be marked on the map (Figure 1) to facilitate reader comprehension.

Reply: Thanks a lot for your comment, this is something we overlooked while writing the paper. We will redesign Figure 1 to better present the geographical overview of the study area, as shown below. And those important locations will be marked there. At the same time, we will remove or replace those terms in the manuscript that may still be confusing. For example, we use “central Shaanxi” to replace “Guanzhong” at line 149, so that readers can refer to Figure 1(a) for the location.

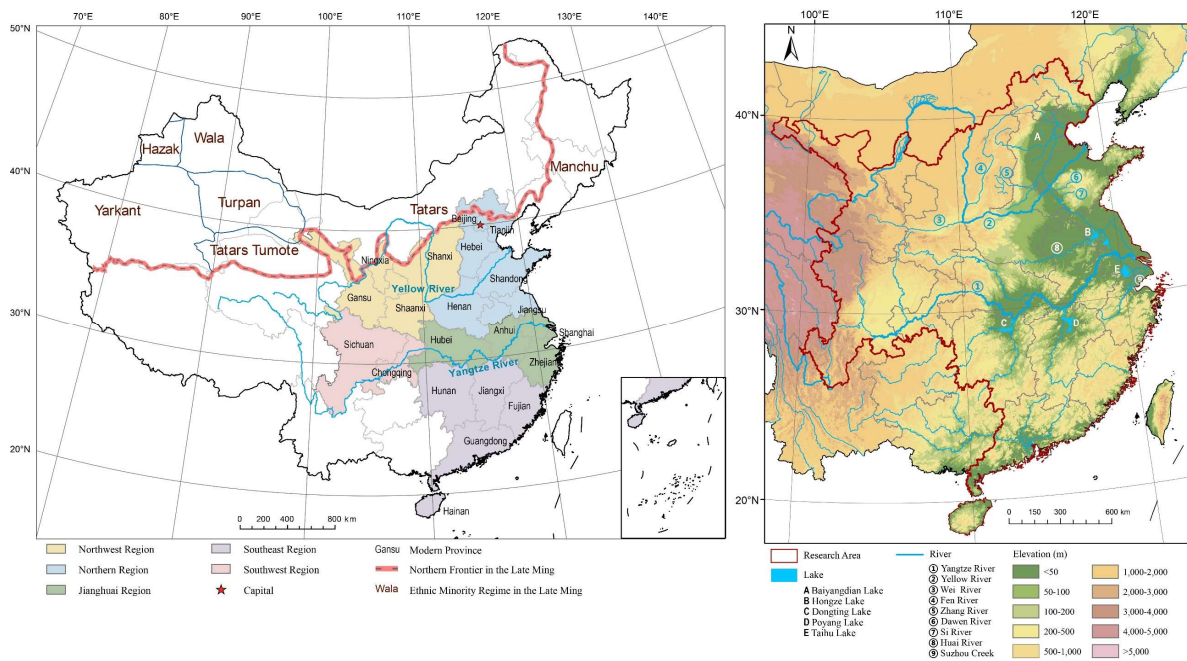


Figure 1: Map of the study area

(a) The location of the study area and subregions; (b) DEM of the study area with main rivers and lakes