

We sincerely appreciate your time and expertise in reviewing our paper. Your comments are helpful, facilitating us to improve our work. We are also grateful for your insightful suggestions. Please find our responses 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. In the discussion section, the analysis of the impact of other factors on the famine appears somewhat superficial. It could be augmented by considering the "Three Extra Levies" (special taxes imposed for military expenses – the Liao levy: imposed in response to the war with Manchuria—later the Qing dynasty, Suppression levy: imposed in response to large-scale peasant uprisings, and Training levy: imposed for the training of new armies), which intensified the burden on peasants and influenced the famine.**

Reply: Thanks for your suggestion. We will add the “Three Extra Levies” as the fifth factor at line 340. Text:

*(5) The increasing taxes. Due to the Manchu invasion and peasant uprisings, the Ming government imposed additional taxes to meet the escalating military expenditures. The most notable examples were the “Three Extra Levies”: the Liao levy (initiated in 1618 for the war in the northeast), the Suppression levy (initiated in 1637 to quell peasantry uprisings), and the Training levy (initiated in 1639 for training the new army). By 1639, the total amount of these additional levies even exceeded the regular tax revenue of normal years. These increasing taxes further lowered the living standards of the populace and exacerbated social conflicts.*

2. In Figure 1, important locations mentioned in the text should be marked on the map to facilitate reader comprehension. Examples include Guanzhong and the Weihe River.

Reply: We will add another map to illustrate the geographical overview of the study area as Figure 1(b), shown below. And those important locations, especially rivers and lakes, will be marked here. 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 Plain” at line 149, so that readers can refer to Figure 1(a) for the location.

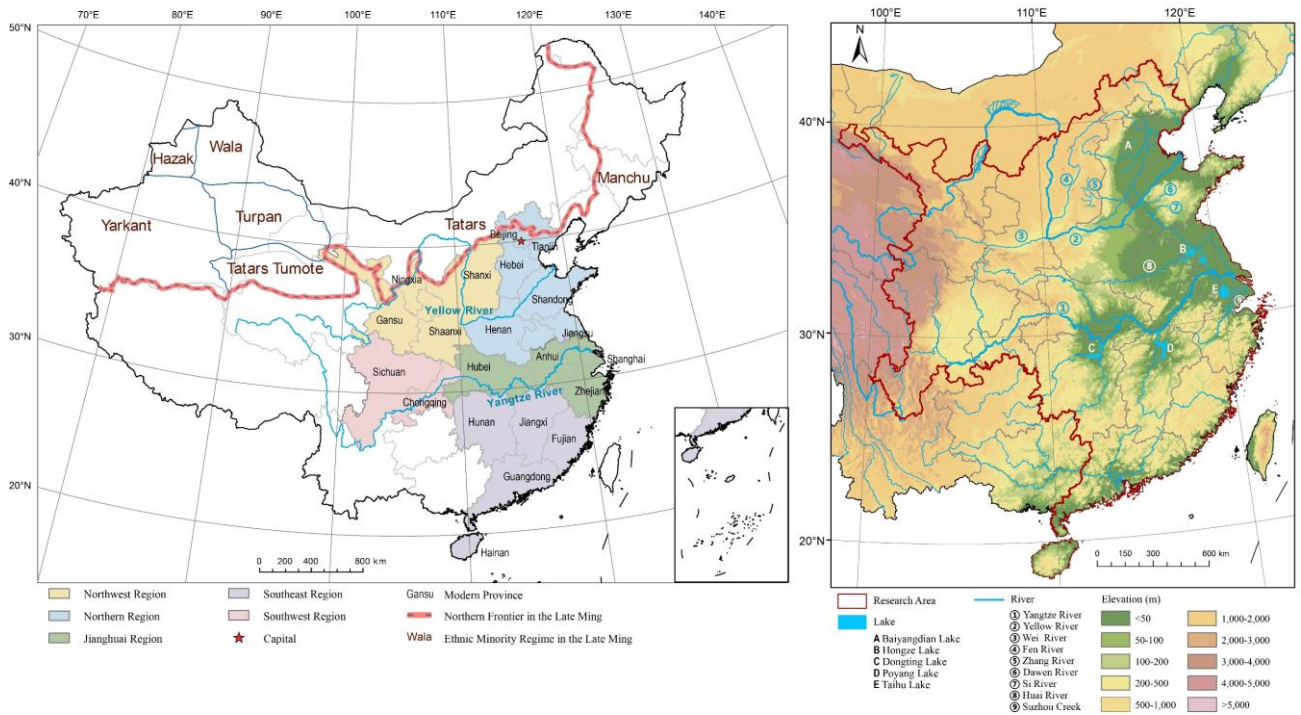


Figure 1: Map of the study area

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

3. In Figure 3, the first two small graphs require certain modifications. The maps for 1633 and 1636 should illustrate the average drought index during the initial phase (1627-1633) and the developmental phase (1634-1637) mentioned in the text, for clearer presentation.

Reply: Thanks for the comment, making us think about this issue carefully. We attempted to create a map illustrating the average drought kernel density index for each phase. However, we found it to be of little help in displaying spatial variability in the drought zone. The primary reason is the differences in the spatial extent of drought from year to year, even within the same phase. Such variability would be diluted in an average kernel density map. For instance, the map below shows the average drought kernel density during the Starting Phase. It looks as if most of the study area experienced mild droughts. In reality, specific areas suffered severe droughts, such as Hebei Province in 1628 and Shaanxi and Shanxi Provinces in 1633, while most areas experienced drought only in a single year.

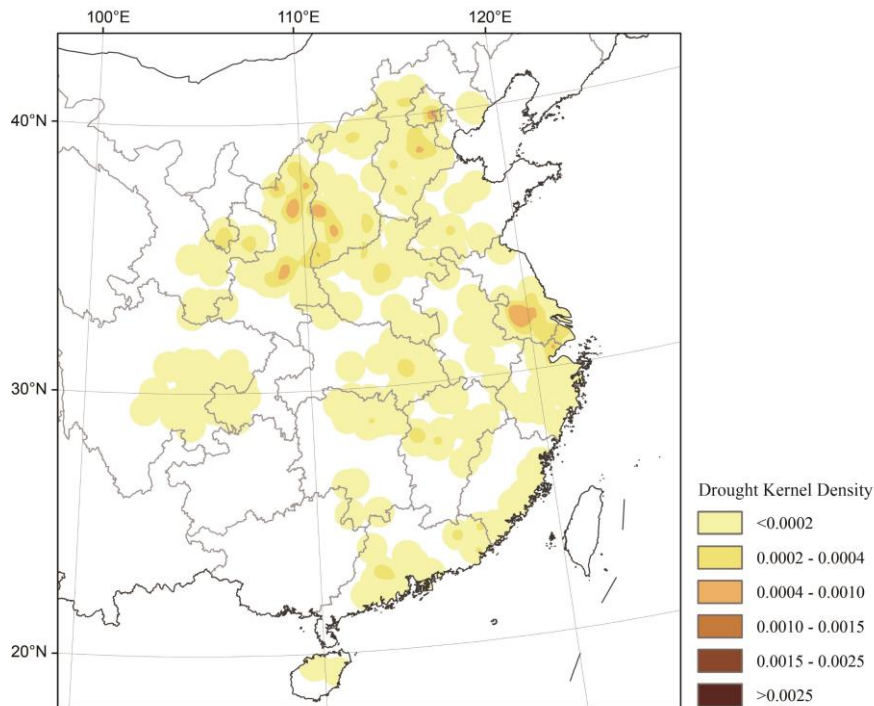


Figure: The average drought kernel density in the starting phase

Therefore, we opted to maintain the original mapping approach, i.e., to present one representative year from each of the Starting, Transition, and Receding Phases, and to display the distribution of droughts for each year during the Peak Phase. Readers who wish to get a more complete picture of the spatial variability of drought are referred to the year-by-year spatial distribution maps provided in Appendix B.