Response to Editor

Dear Prof. Gao,

We greatly appreciate your timely handling of our manuscript. In response to the reviewer's suggestion to improve the readability, we have made the following changes:
a) We simplified the language throughout the manuscript, including in Appendices A, B, and C, using more concise phrasing while maintaining the original meaning.
b) Some descriptions in the results section were moved to the methods or removed to emphasize the key findings.
All changes are highlighted in blue in the revised version. Thank you for your support, and we look forward to the successful publication.

Best,
Yuan Liu (on behalf of all co-authors)

Response to Reviewer #2

General Comments: The authors have made great efforts to revise the manuscript and have effectively addressed most of my concerns. The structure and quality of the presentation have improved considerably.

Reply: We greatly appreciate your recognition, as well as your previous review and guidance, which have been very valuable to us.

R2C1: 1) Some paragraphs are overly long and could be more concise. I recommend limiting each paragraph to about 10 lines by either splitting or simplifying the descriptions. For example, in Section 2.2, consider dividing the first paragraph into two: one focusing on the driver candidates and the other on the ML methods.
Reply: DONE. In response to your feedback, we have made two key changes to improve the manuscript's clarity and readability: First, we refined the language throughout the manuscript and Appendices A, B, and C, with all changes highlighted in blue. Additionally, following your guidance and examples, we divided several sections into shorter paragraphs to keep each paragraph within 10 lines.
The paragraph divisions are at: Line 164, Line 243, Line 387, Line 438, and Line 465.

Additionally, we have added the heading "2.4 Other Statistical Analysis" in the methods section to better organize the content (Line 224).

R2C2: 2) The contents in the results should appear in the order from important ones to less important ones. For instance, in section 3.2, the authors could firstly describe their findings, and then the robustness of the methods (or just move them into method sections). Similarly, in section 3.3, the comparison of the two models is less important than the findings based on the current model, and should appear later, possibly only in the

discussion section.

Reply: DONE. We greatly appreciate your detailed guidance. Following your suggestion, we have moved the relevant content from Section 3.2 to Methods 2.2. Regarding the model comparison analysis in Section 3.3, we found it to be repetitive with the discussion in Section 4.1, so we have removed it.

Relevant text reads (Line 170-175):

> *"Table S2 presents the performance metrics of two models. Despite above efforts to prevent overfitting, the relatively low validation accuracy still reveals SHAP model's susceptibility to misallocating feature importance among highly correlated variables. To address this, we generated multiple training subsets through categorical divisions of temporal scales (8-day, 16-day, monthly) and spatial partitions (drought gradient and land cover types: cropland, forest, grassland). This approach enabled us to obtain diverse importance rankings across China's regions and derive statistically robust importance hierarchies through distribution analysis (Fig. 4, S3)."*

We truly appreciate your insightful guidance and invaluable contributions to improving our manuscript. Best regards.