Response to Editor:

While both reviewers are satisfied with the revisions overall, some minor revisions are still needed before acceptance. I look forward to your updated manuscript.

Respond: Thank you for your long-term attention and guidance to the thesis. These suggestions are of great value for improving the quality of the article, and we have completed the corresponding revisions based on the opinions. Thank you sincerely again.

Response to Reviewer#4:

Thank you for your comments. We take each suggestion very seriously and will provide a detailed response. In the revised manuscript, we have revised the content of the manuscript. **The revisions in the manuscript are indicated using blue font.** Below is a comprehensive overview of the modifications we have made:

General comments:

The manuscript has been reviewed by two experts in the previous round, and the author substantially revised the manuscript based on the comments from reviewers and editor. I think the manuscript has been improved in quality and logic after the revision. I only has some minor comment on this manuscript.Overall, the authors have invested considerable effort in writing and revising this article. I recommend that the article be accepted with minor revisions.

Respond: Thank you for your valuable comments on the article. We have checked and revised the paper according to your suggestions.

Minors comments:

(1) Lines 251-256: The subplot labels in Figure 5 are not clear enough, and the legend position needs adjustment.

Respond: We have revised the subplot labels in Figure 5 and optimized the legend, as shown below:

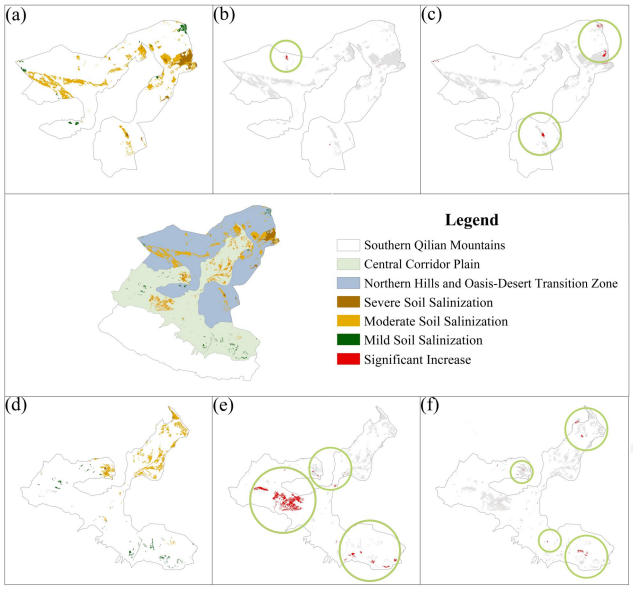
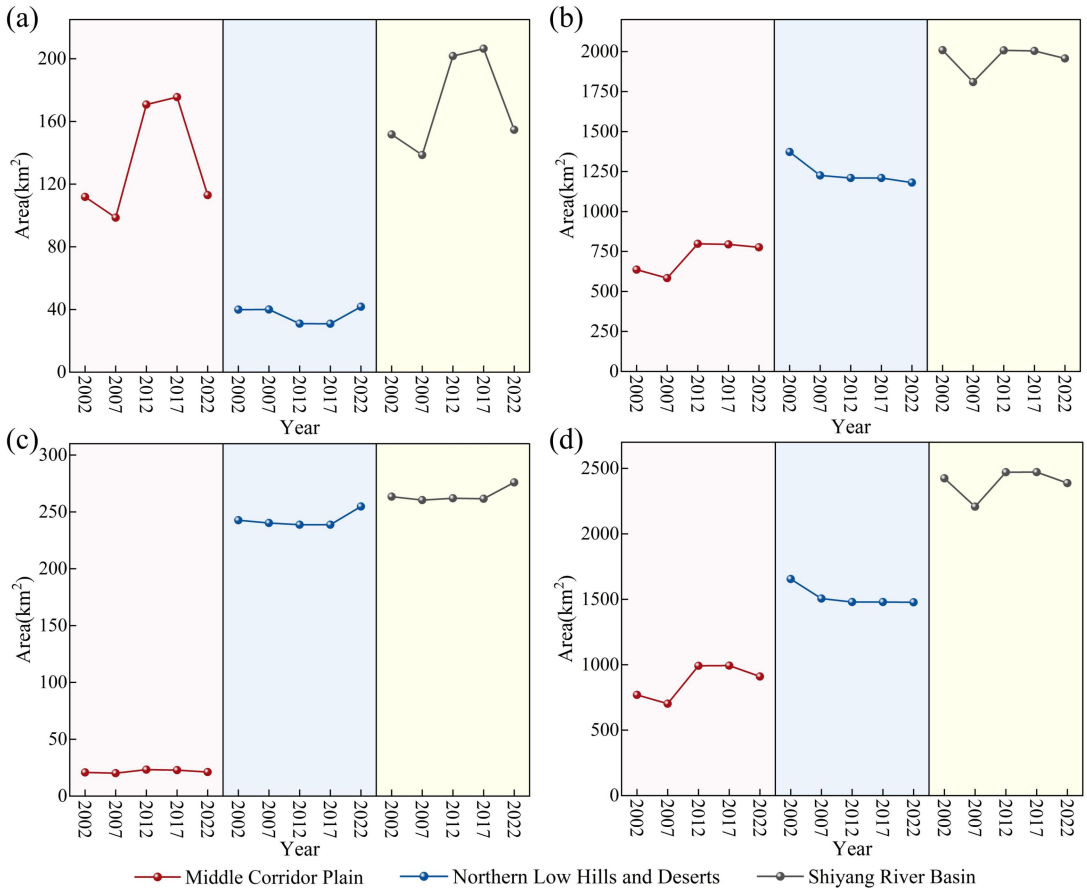


Figure 5. Spatial Distribution Map of Salinization in the Shiyang River Basin (a: Distribution of soil salinization in the northern hills and oasis-desert transition zone in 2002; b-c: Expansion areas in soil salinization in the northern hills and oasis-desert transition zone in 2012 and 2022; d: Distribution of soil salinization in the central corridor plain in 2002; e-f: Expansion areas in soil salinization in the central corridor plain in 2012 and 2022)

(2) Line 281: The font size of the y-axis title in Figure 6 is too small.

Respond: We have moderately adjusted the y-axis of Figure 6 to make it easier to observe, as shown below:



(3) Line 407: The irrigation district numbers in Figure 10 are too small and difficult to identify.

Respond: Thank you for your suggestions, and we have made the modifications, as shown below:

Surface water and groundwater irrigation are the primary irrigation methods in the Shiyang River Basin, significantly impacting soil salinization in both agricultural and non-agricultural areas (Fig.9). The Shiyang River Basin comprises 27 irrigation

districts (Fig.10), with seriously salinized districts concentrated in the middle and lower reaches, while non-salinized districts are located in the upstream region. Severe soil salinization includes Hongyashan Irrigation District (HYSID), Changning Irrigation District (CNID), and Huanhe Irrigation District (HHID). Moderate soil salinization includes Dongdahe Irrigation District (DDHID), Nanhu Irrigation District (NHID), Donghe Irrigation District (DHID), Xiyinghe Irrigation District (XYHID), Siba Irrigation District (SBID), and Qinghe Irrigation District (QHID). Among these, DDHID experienced particularly severe soil salinization, with a significant increase in salinized area during 2007–2012. Mild soil salinization includes Gulanghe Irrigation District (GLHID), Wujiaojing Irrigation District (WJJID), Huangyanghe Irrigation District (HYHID), Yinhuang Irrigation District (YHID), Qiduntai Irrigation District (QDTID), Jingdian Irrigation District (JDID), Dajinghe Irrigation District (DJHID), Qingyuanjing Irrigation District (QYJID), Zamuhe Irrigation District (ZMHID), Jintahe Irrigation District (JTHID), Jingtaichuan Irrigation District (JTCID), Jinyangjingyuan Irrigation District (JYJYID), Jinchuan Irrigation District (JCID), Yongchang Irrigation District (YCID), and Xihe Irrigation District (XHID). GLHID and WJJID showed a continuous increase in salinized area from 2002 to 2017 but experienced a reduction from 2017 to 2022, while other districts saw minimal changes in salinization area. Zhangyi Irrigation District (ZYID), Gufenghe Irrigation District (GFHID), and Tuiguangzhan Irrigation District (TGZID) have no salinization. Overall, irrigation is the main factor influencing the gradual increase in soil salinization from upstream to downstream in the Shiyang River Basin, highlighting the profound impact of human agricultural activities on salinization in the basin.

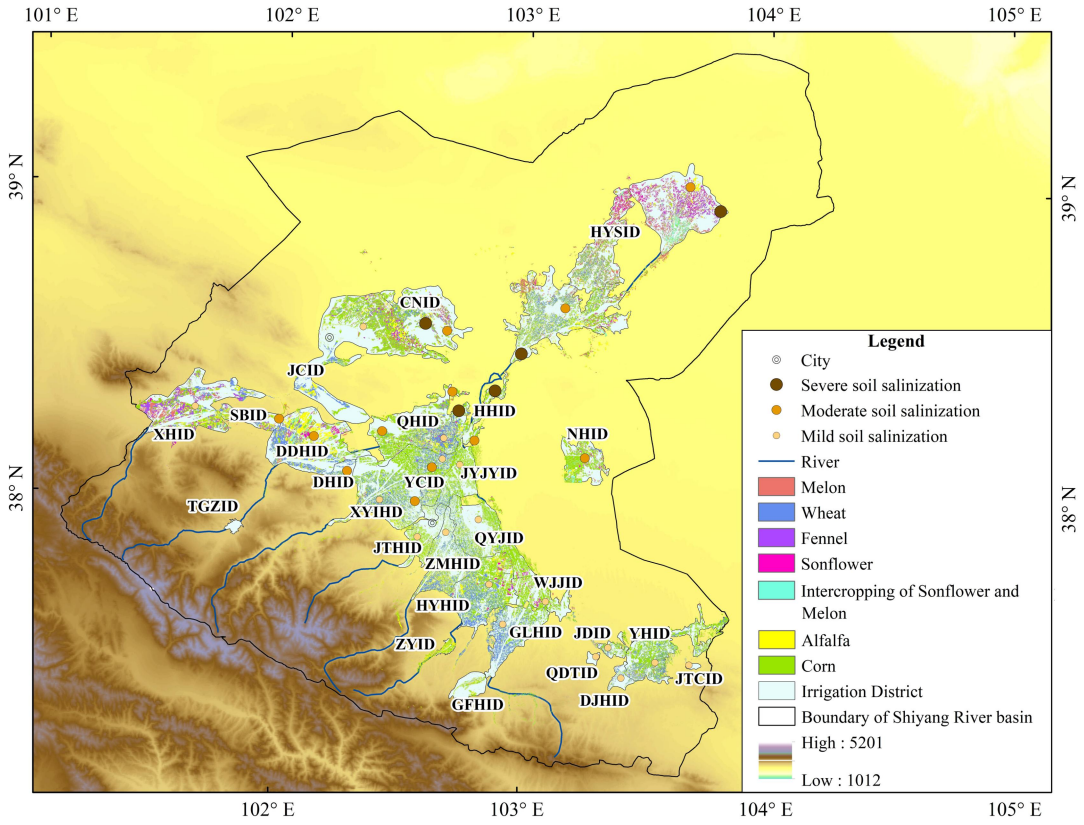


Figure 10. Distribution of irrigation areas in the Shiyang River Basin

(4) Line 101: "Xiyang River" should be "Xiying River".

Respond: Thank you for your suggestions. We have corrected the erroneous expressions in the original text, as shown below:

It consists of eight major tributaries: the Dajing River, the Gulang River, the Huangyang River, the Zamu River, the Jinta River, and the Xiying River (Fig. 1).

(5) Line 241: "especially in the downstream" should be "especially in the downstream area".

Respond: Thank you for raising the questions, and we have made the revisions, as shown below:

The results showed that the salinization of the basin gradually increased from upstream to downstream, especially in the downstream area of the basin near Qingtu Lake, where the salinization of the soil was the most serious.

(6) Line 298: "altered evaporation process" is not accurately expressed.

Respond: Thank you for raising the questions. Our original intention was to express that external water diversion irrigation directly increases surface and soil water

content by artificially introducing water sources, a process that disrupts the original "precipitation-evaporation-infiltration" balance. Meanwhile, we have revised the language in the original text, as shown below:

Its negative effects are reflected in two aspects: the evaporation process altered by the introduced water for irrigation, and the rise of groundwater level caused by the inflow of external water (Duan et al., 2022).

(7) Line 444: "small variations" is not precise enough in wording.

Respond: Thank you for pointing out the issues, and we have made the amendments, as shown below:

The basin's salinization area showed overall minimal variation, but salinity gradually intensified from southwest to northeast.

(8) Line 490: Abu Hammad citation format is incorrect, should be "Abu Hammad and Tumeizi".

Respond: We have checked and corrected the citations in the article, as shown below:

Abu Hammad, A. and Tumeizi, A.: Land degradation: socioeconomic and environmental causes and consequences in the eastern Mediterranean, Land Degrad. Dev., 23(3), 216-226, https://doi.org/10.1002/ldr.1069, 2012.

(9) Verify the references in the text. Since papers on the relationship between saline-alkali land and hydrology are relatively limited, although such research is very important, it is recommended to add some books or research reports as references. For example:Saline-alkali Soil Science and Comprehensive Utilization (Hu et al., 2025); Practical Q&A and Case Analysis of Saline-alkali Land Improvement Technology (Liang et al., 2018).

Respond: Thank you for your suggestions. We have added the relevant citations to the paper, as shown below:

Soil salinization can be classified into primary salinization and secondary salinization based on its causes (Liang et al., 2018).

Remote sensing technology has been widely used to assess soil salinization, and feature spectral characteristics are essential markers for identifying saline soils (Ivushkin et al., 2019; Hu et al., 2024).

Hu, S., Li, Rong., and Gao, H.: Saline-alkali Soil Science and Comprehensive Utilization, Science Press., ISBN 978-7-030-80064-0, 2024.

Liang, F., Li, Z., and Zhang, L.: Practical Q&A and Case Analysis of Saline-alkali Land Improvement Technology, China Agriculture Press ., ISBN 978-7-109-24618-8, 2018.