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River Regulation Reshaped Human-water Interaction in the Lower Yellow River Floodplain

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Floodplains have been crucial agricultural and populated areas throughout history and in present. Rivers typically shape the human activities within floodplains through water supply and flood risk, forming unique human-water interaction patterns. Here, we focus on the Lower Yellow River Floodplain, where continuous levees divide homogenous cultivated plain with different flood risk, creating a quasi-natural experiment, while the river's hydrology has undergone dramatic transformation since the 1990s. We utilize Landsat-based data including open-surface water bodies, cropland and NDVI to analyze the mechanism of river-agriculture interaction and whether this mechanism has changed. The results reveal that agriculture activities were less developed inside the floodplain than outside, and were even worse in regions closest to the river. This was attributed to frequent channel diversions, heightened flood threat, and actual inundation within the floodplain. However, the Lower Yellow River experienced a silt-load reduction, trenching, and channel stabilization after the late 1990s, while submerged cropland area in the floodplain also decreased. The declining flood threat has encouraged cultivation and agriculture investment in the floodplain, consequently reducing the productivity difference across the levees. This study illustrates a prototypical human-water interaction pattern in floodplains, underscoring the significance of effective river management for sustainable development in these regions, and provides a reference on understanding regional human-environment relationship in other floodplain areas.