Supplementary materials captions

Section S1. Data acquisition details

Figure S1. Procedure for downloading elevation data from the Geospatial Data Cloud platform.

Figure S2. Procedure for acquiring soil and rock classification data from ISRIC-SOTER and visualization in ArcGIS.

Figure S3. Workflow for extracting river system water quality classification from MEE and linking with sampling points in ArcGIS.

Section S2. Detailed rice cultivars used in this study



Figure S1. Procedure for downloading elevation data from the Geospatial Data Cloud platform. Visit the Geospatial Data Cloud platform, click on “Advanced Search,” select “Hunan Province” as the spatial region, and choose the dataset “SRTMDEM 90M” to download the file srtm_59_07. Since elevation changes minimally over time, the elevation data for all sampling points in this study were extracted using the 2024 dataset.

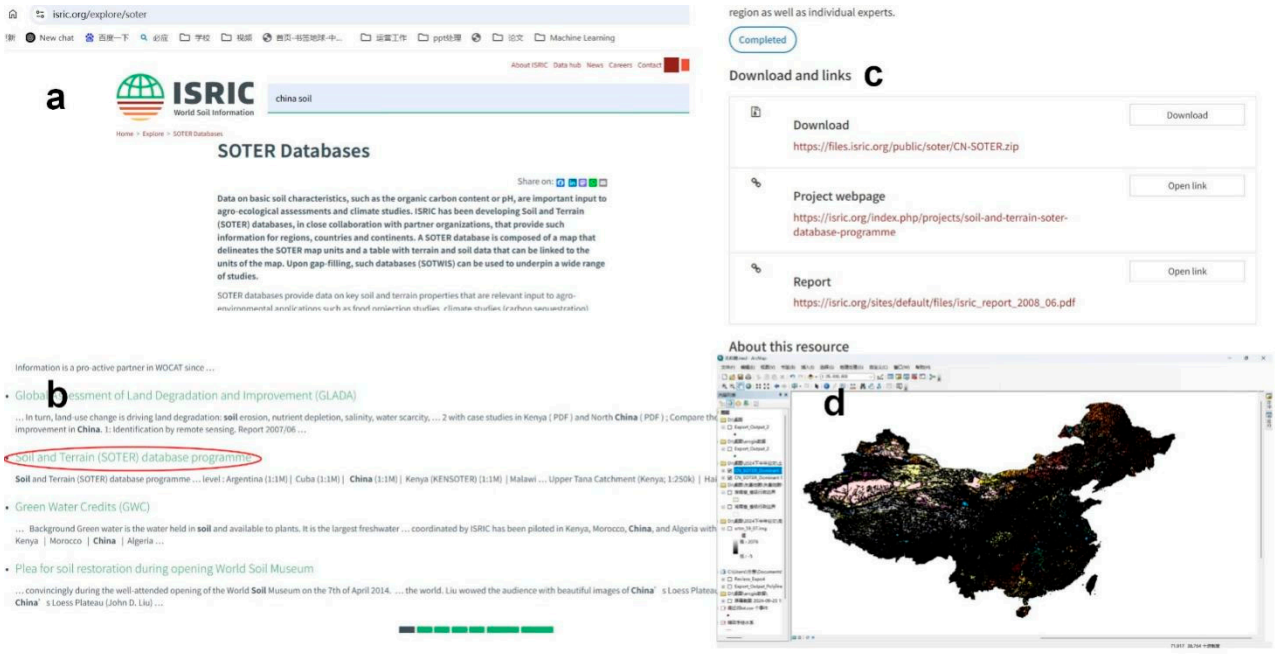


Figure S2. Procedure for acquiring soil and rock classification data from ISRIC-SOTER and visualization in ArcGIS. Visit https://www.isric.org/explore/soter, search with the keywords “china and soil”, and locate the Soil and Terrain Database Programme. Click to enter the page, scroll down to download the dataset, and open it using ArcGIS for further processing.



Figure S3. Workflow for extracting river system water quality classification from MEE and linking with sampling points in ArcGIS.The national surface water quality report for March 2014 was downloaded from the Ministry of Ecology and Environment of China. The water quality classification map of the Yangtze River Basin was extracted and georeferenced in ArcGIS using the vector map of Hunan Province's administrative boundaries. River systems were manually digitized and assigned corresponding water quality levels based on color coding. Then, using spatial analysis tools such as nearest-neighbor analysis, each sampling point was matched to its nearest river. Finally, multi-value extraction to points was conducted to assign a water quality classification to each sampling point.

Rice cultivars

Yue You 712, Xing 2, C Liangyou 4489, Shenyou 9559, Tianyou 998, Yuyouhua adhesive, Peiliangyou 199, Lu You 5814, Tianyou 199, China Resources No.3, Y Liangyou 900, Glutinous rice, C Liangyou 87, C liang 386, Zaoyou No.3, Hybrid rice, Bingyou 488, Bingyou 2108, C Liangyou 266, C Liangyou 267, Jingyou 498, Jinyou 499, Jinyou 500, Jinyou 501, Jinyou 502, Jinyou 504, Jinyou 505, Jinyou 506, Jinyou 507, Jinyou 508, Jinyou 509, Jinyou 510, Fengyuanyou 273, Fengyuanyou 274, Fengyuanyou 275, Fengyuanyou 276, Fengyuanyou 277, Fengyuanyou 278, Fengyuanyou 279, Lu Liangyou 106, Y Liangyou No.1, Y Liangyou 263, Zhongyou 9918, T You 640, Y Liangyou 096, Wuyou 570, Chuanxiangyou No. 8, Yiyou 701, Guangliangyou 210, Tianyou 2168, V You 644, Wuyou 613, T You 288, Heliangyou 114, T You 2168, Anhui Rice 153, Weiyou 644, Jade Needle Fragrance, Tan Liangyou 83, Zhongjiuyou 288, Wuyou 666, New Liangyou 380, He You 328, Tianyou 122, Zhefu No.7, Shenyou 958.