

Supplementary Materials

Table S1. Descriptive statistics of soil total nitrogen (g/kg) for the LUCAS 2018 soil dataset used in this study.

Soil property	Minimum	Maximum	Mean	Median	Standard deviation
STN	0.20	20.00	2.01	1.50	1.64

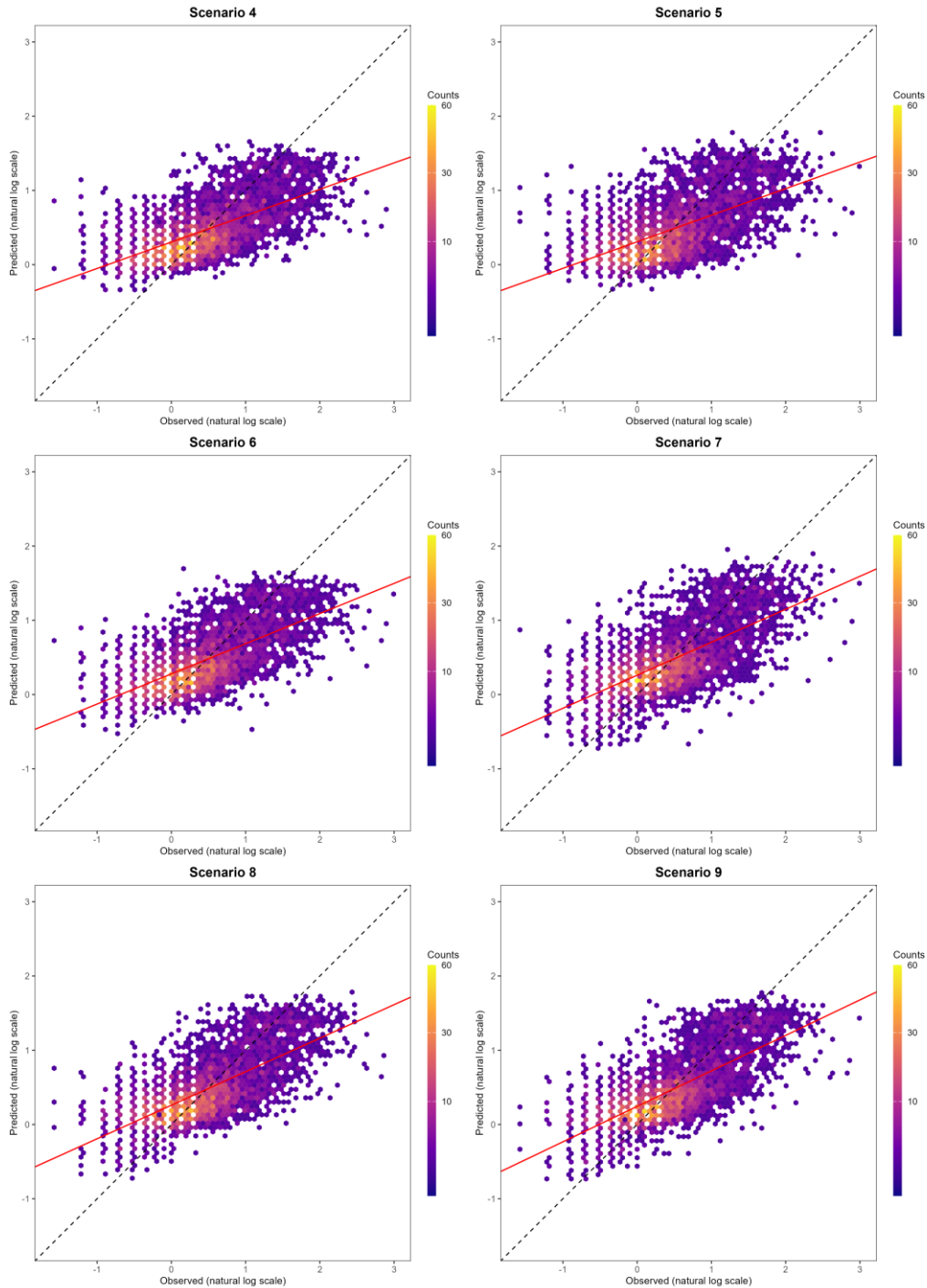


Figure S1. Predicted versus observed soil total nitrogen based on 10-fold cross-validation for Scenarios 4 to 9 using the RF algorithm. The red line represents the linear fit of observed and predicted values, and the black line is the 1:1 line.

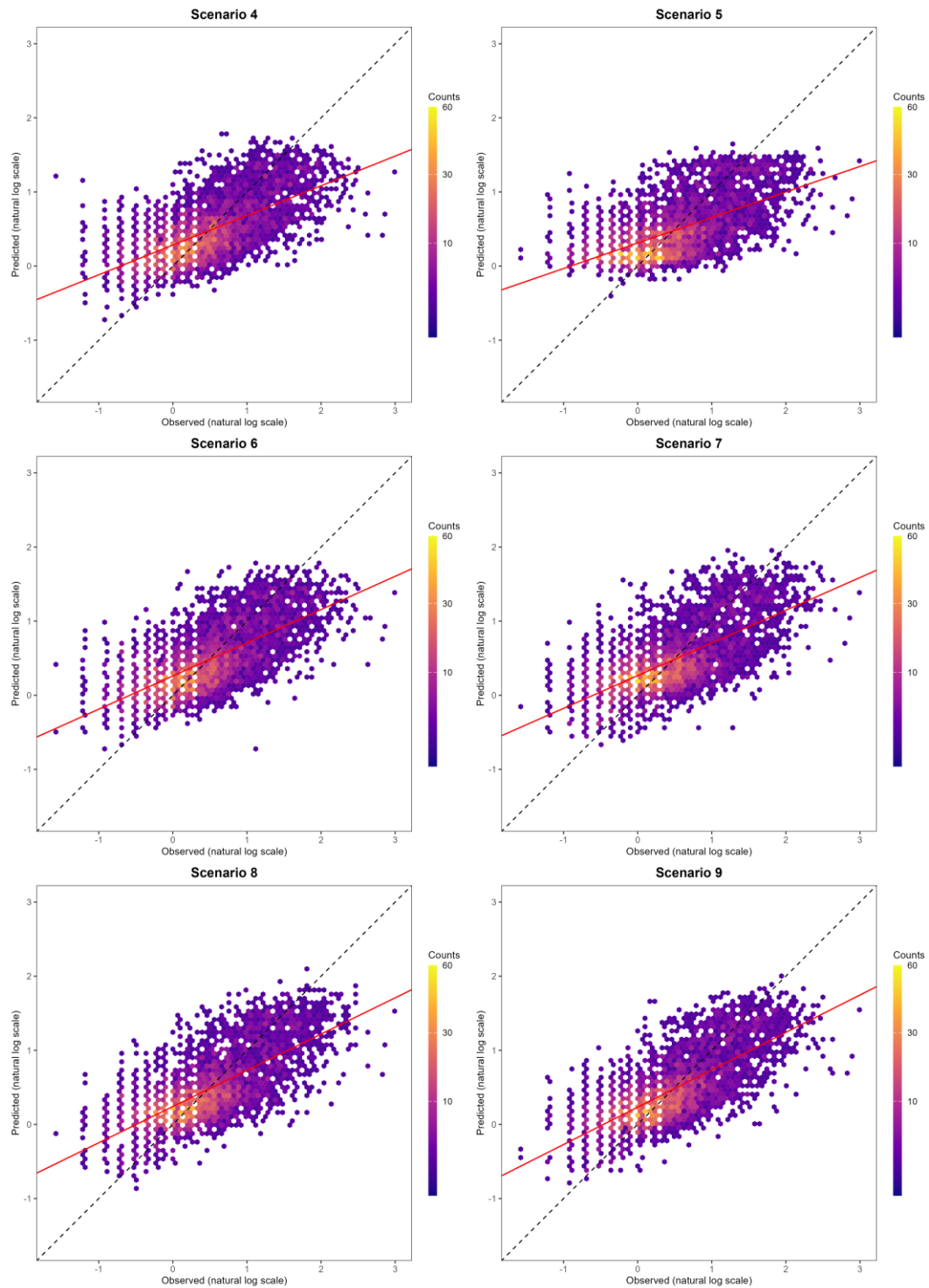


Figure S2. Predicted versus observed soil total nitrogen based on 10-fold cross-validation for Scenarios 4 to 9 using the XGBoost algorithm. The red line represents the linear fit of observed and predicted values, and the black line is the 1:1 line.

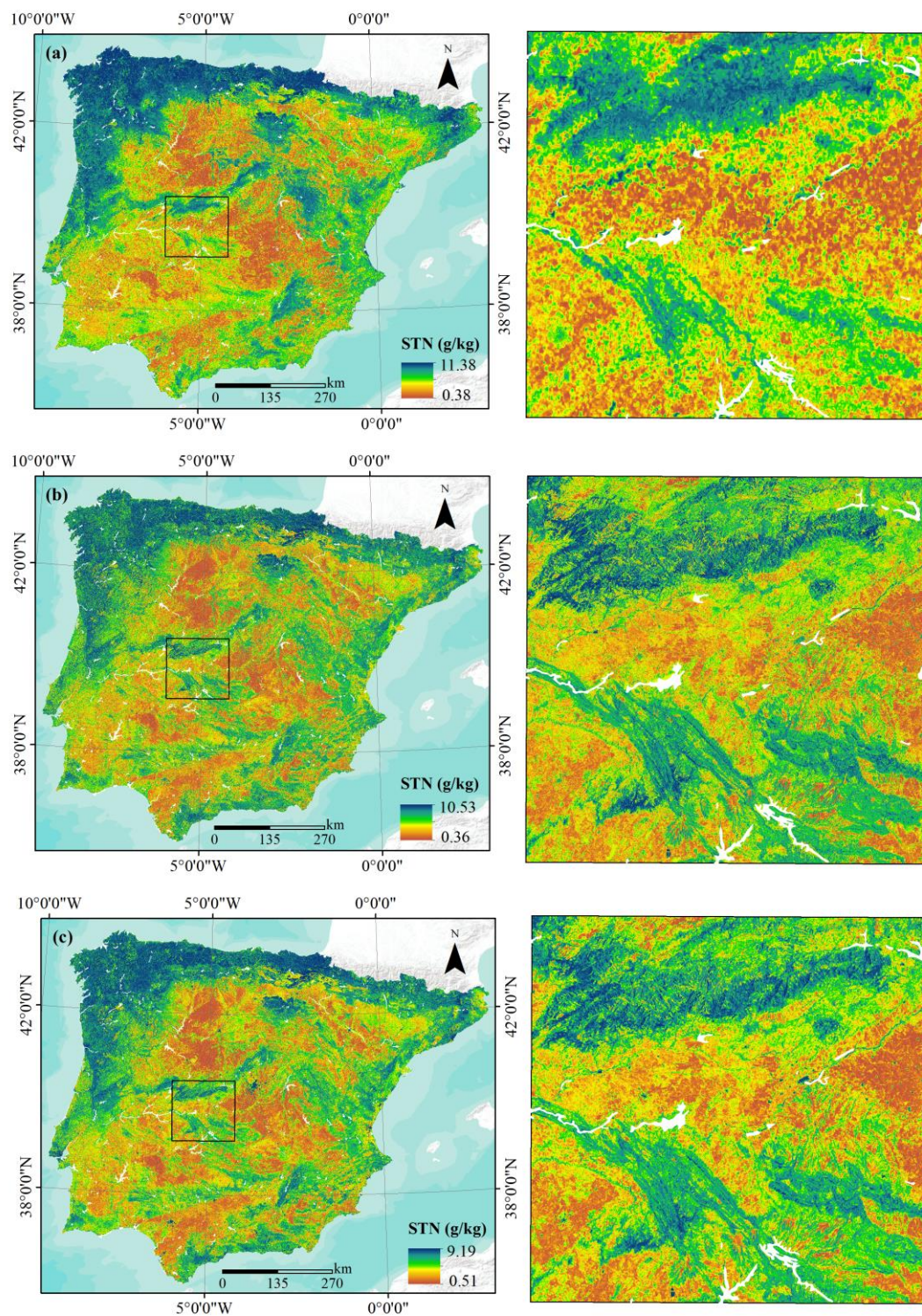


Figure S3. Spatial distribution of STN predicted by the RF model across the Iberian Peninsula under scenarios based on individual SAR features (Scenarios 1–3). The subplots correspond to predictions using single categories of radar information: (a) Scenario 1 (SAR coherence); (b) Scenario 2 (SAR backscatter); and (c) Scenario 3 (SAR texture). The black rectangles and adjacent panels illustrate zoomed-in details of the prediction maps.

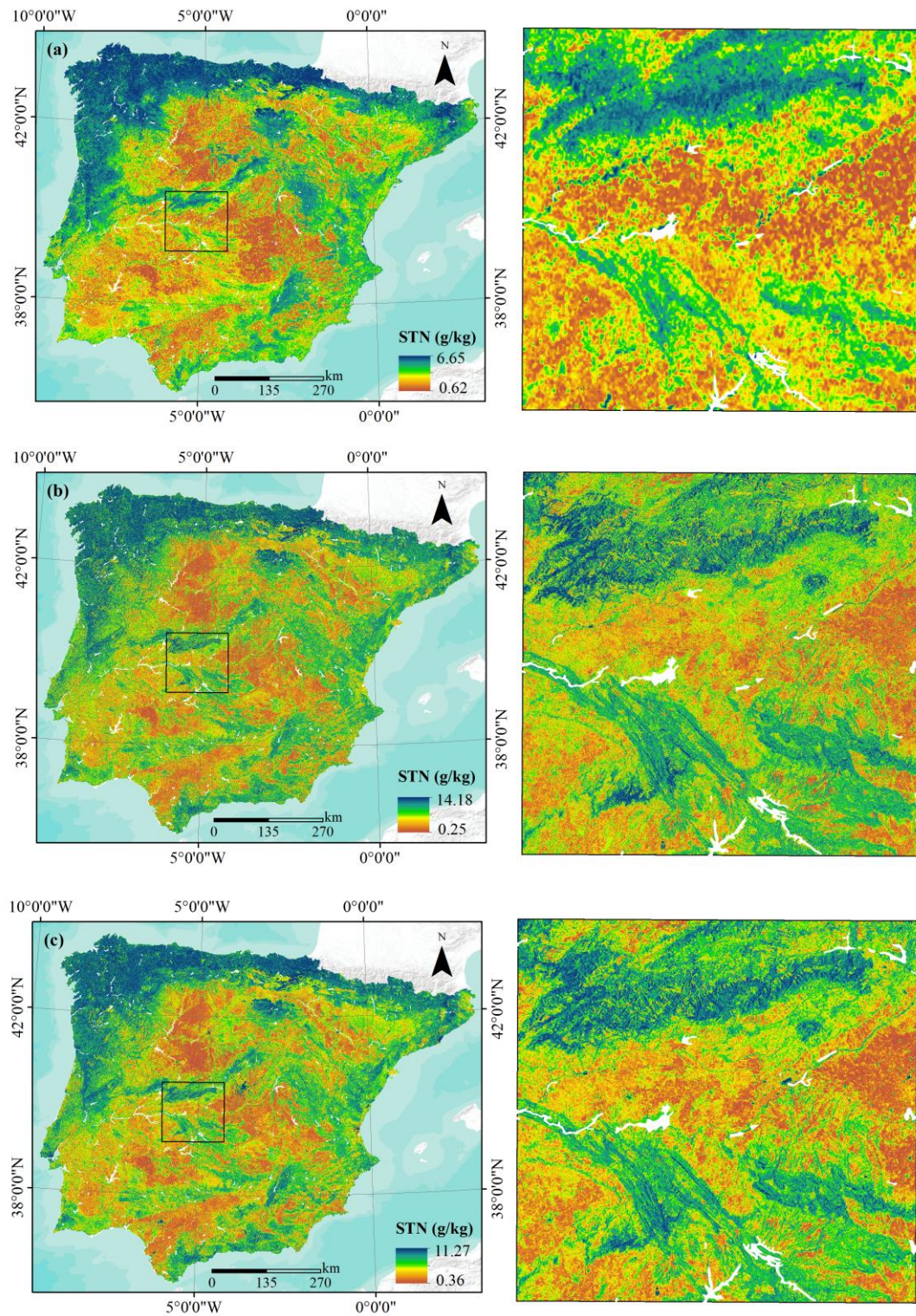


Figure S4. Spatial distribution of STN predicted by the XGBoost model across the Iberian Peninsula under scenarios based on individual SAR features (Scenarios 1–3). The subplots correspond to predictions using single categories of radar information: (a) Scenario 1 (SAR coherence); (b) Scenario 2 (SAR backscatter); and (c) Scenario 3 (SAR texture). The black rectangles and adjacent panels illustrate zoomed-in details of the prediction maps.

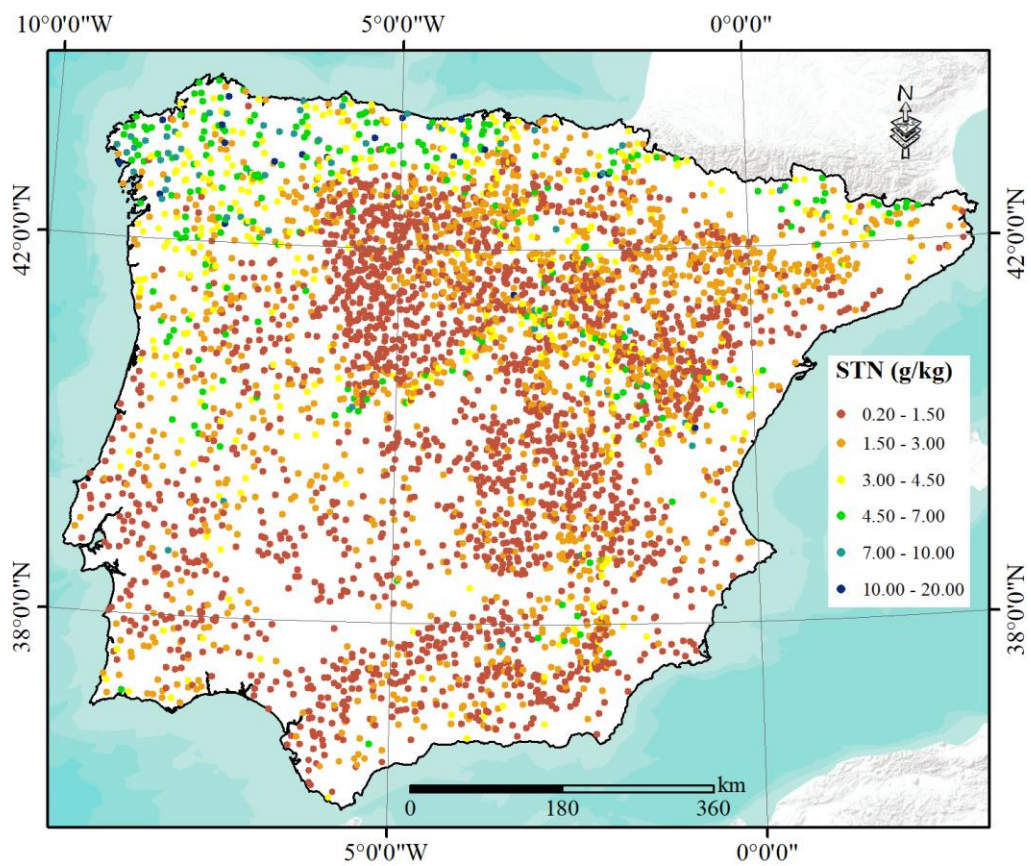


Figure S5. Map of the original LUCAS soil sampling points showing the spatial variability in measured STN content across the study area.