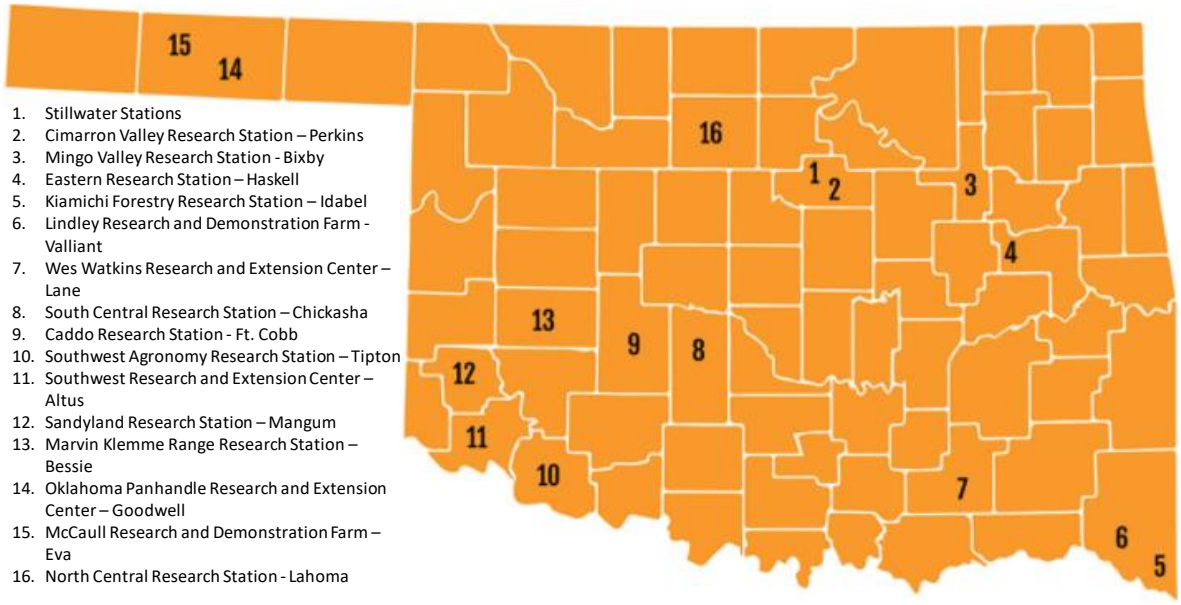

1. Stillwater Stations
2. Cimarron Valley Research Station – Perkins
3. Mingo Valley Research Station - Bixby
4. Eastern Research Station – Haskell
5. Kiamichi Forestry Research Station – Idabel
6. Lindley Research and Demonstration Farm - Valliant
7. Wes Watkins Research and Extension Center – Lane
8. South Central Research Station – Chickasha
9. Caddo Research Station - Ft. Cobb
10. Southwest Agronomy Research Station – Tipton
11. Southwest Research and Extension Center – Altus
12. Sandyland Research Station – Mangum
13. Marvin Klemme Range Research Station – Bessie
14. Oklahoma Panhandle Research and Extension Center – Goodwell
15. McCaull Research and Demonstration Farm – Eva
16. North Central Research Station - Lahoma

Figure S1. The locations of field research stations of Oklahoma State University where plant samples were collected.

Table S1. Summary of elemental K-edge absorption energies that were scanned under 50 keV pXRF analysis settings, and the pXRF limit of detection (LOD) and maximum limit for the 'Soil Nutrient and Metal' calibration provided by the manufacturer.

Element	**K-edge (keV)**	**----------pXRF (mg kg^{-1})----------**	
		LOD	**Maximum limit** [a]
P	2.14155	30	1900
K	3.6074	40	50000
Ca	4.0381	25	10000
Mg	1.305	600	252000
S	2.472	35	133000
Cu	8.979	<5	30800
Fe	7.112	15	248000
Zn	9.6586	<5	99000
Mn	6.659	15	2100

[a] Maximum value of the calibration method used.

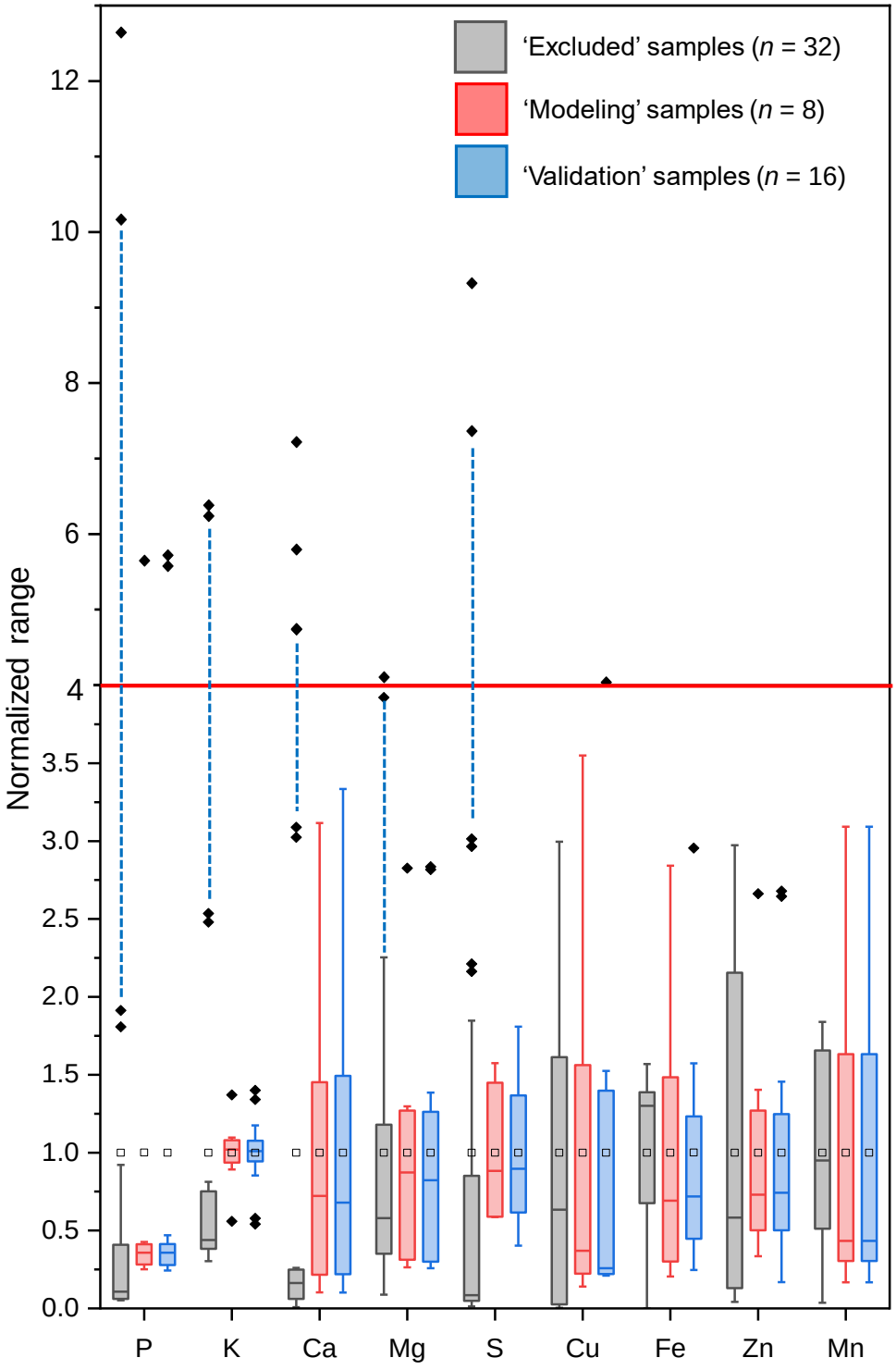

Figure S2. Box-plots of 'excluded', 'modeling', and 'validation' datasets. Single results were divided by the average to normalize data and plot variables in the same range. Boxes span the 25th to 75th data percentile, whiskers represent 1.5 × the interquartile range, horizontal lines denote the median, squared points denote the mean, and ♦ denotes the outlier. The horizontal red line separates the dataset from extreme values. Vertical blue dashed lines highlight extreme values belonging to the 'excluded' dataset.