

Digital Mapping of Heavy Metals in Qatar Soils using Remote Sensing and Ancillary Data

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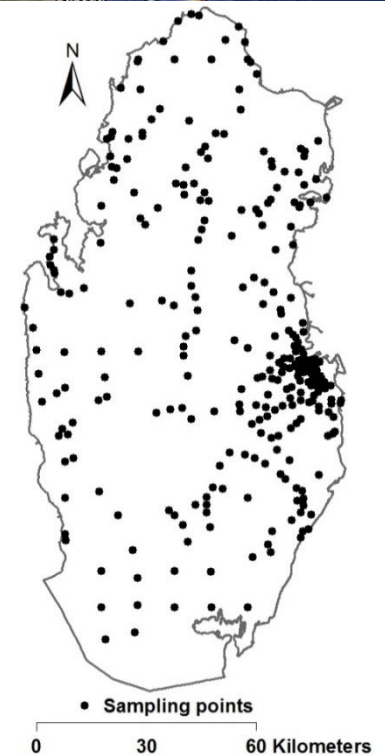
Materials and Methods

Study area :

- Approximately 11,437 km²
- Rainfall occurs
- Vegetation covers arid zones

Sampling :

- A total of 300 topsoil samples
- Six elements (As, Cr, Ni, Cu, Pb and Zn)



Environmental variables

Geopedological information:

Geology; Distance to geological structures; Soil type

Hydromorphological data:

Elevation; Slope gradient; Distance to drainage line

Anthropogenic information:

Proximity to roads; Night light image; Distance to environmental Hotspots

**Landsat 8 false-color image
Jan 2014**

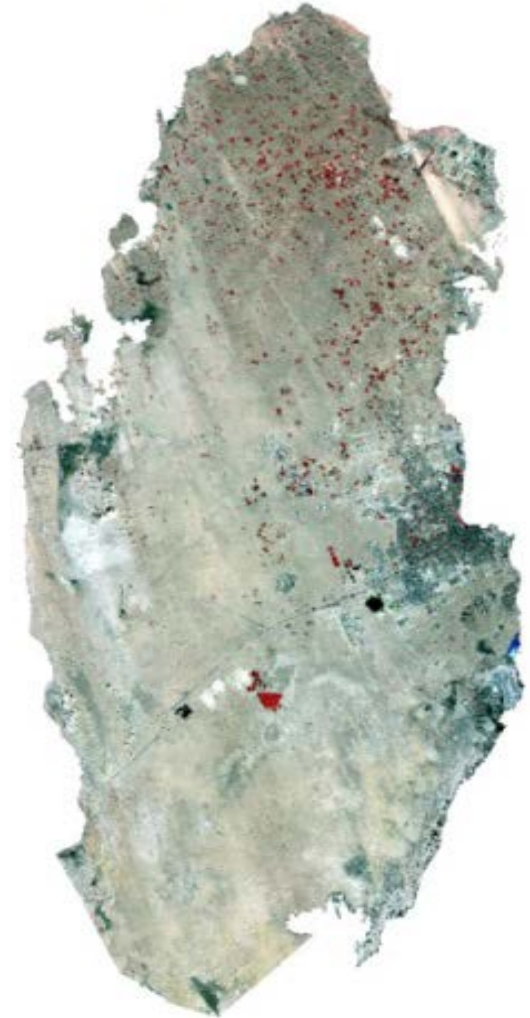
Landsat-8 multi-temporal observation

(January, February, April, May, Jun, July,
August, September, October in 2014)

Different spectral indices, such as:

Tasseled Cap transformation,

Biophysical composition index(BCI)



Calibration (75%) and validation (25%)

Cubist regression tool

Results

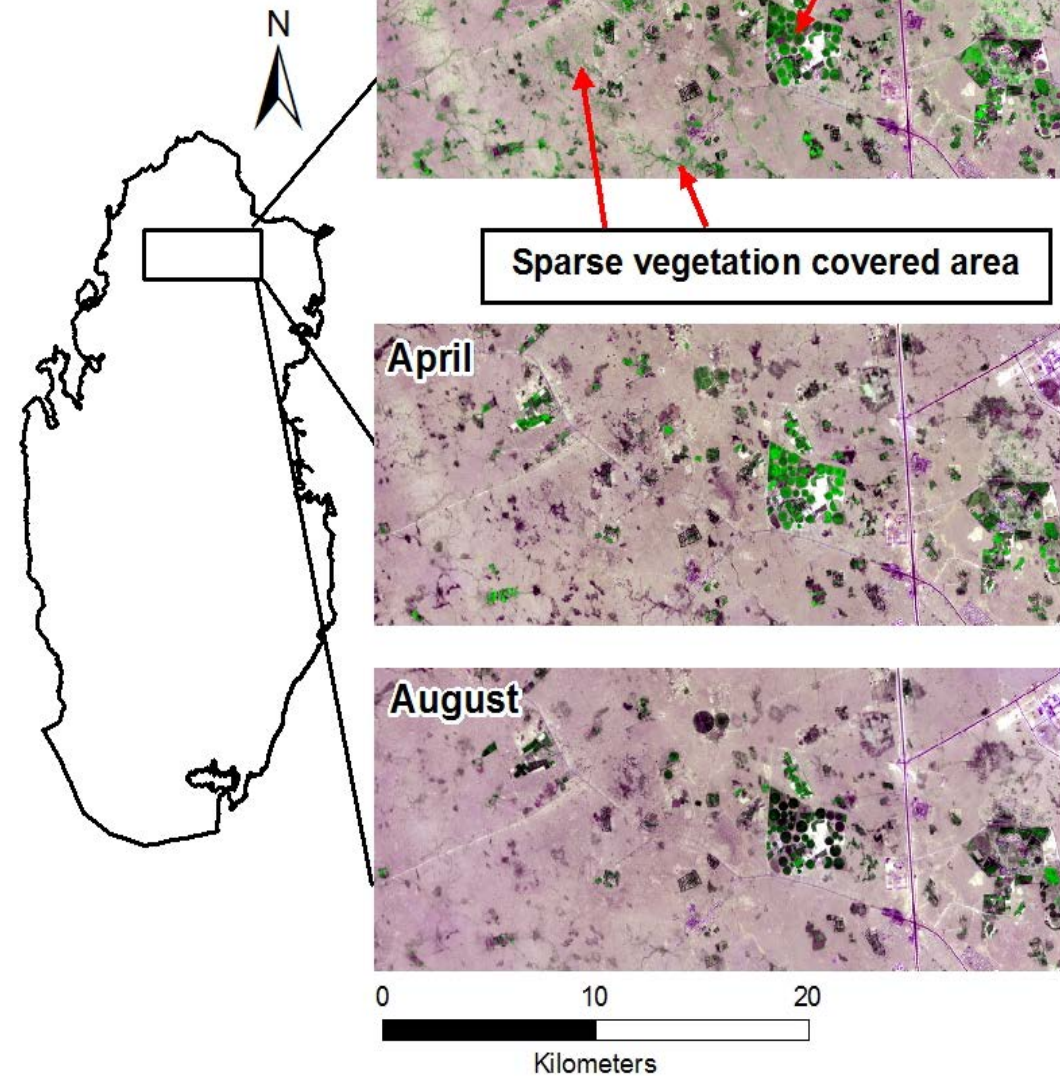
Element (mg kg ⁻¹)	Results			
	Range	RMSE	R ²	RPIQ
Zn	2.8-130.9	12.18	0.51	0.83
Cu	0.6-28.8	2.10	0.74	1.37
Cr	1.9-64.9	5.90	0.53	1.54
Pb	0.5-14.1	1.49	0.53	1.10
Ni	2.3-76.1	5.19	0.47	1.06
As	0.4-7.9	0.58	0.60	1.48

RS variable importance:

RS images seasonal
dependency

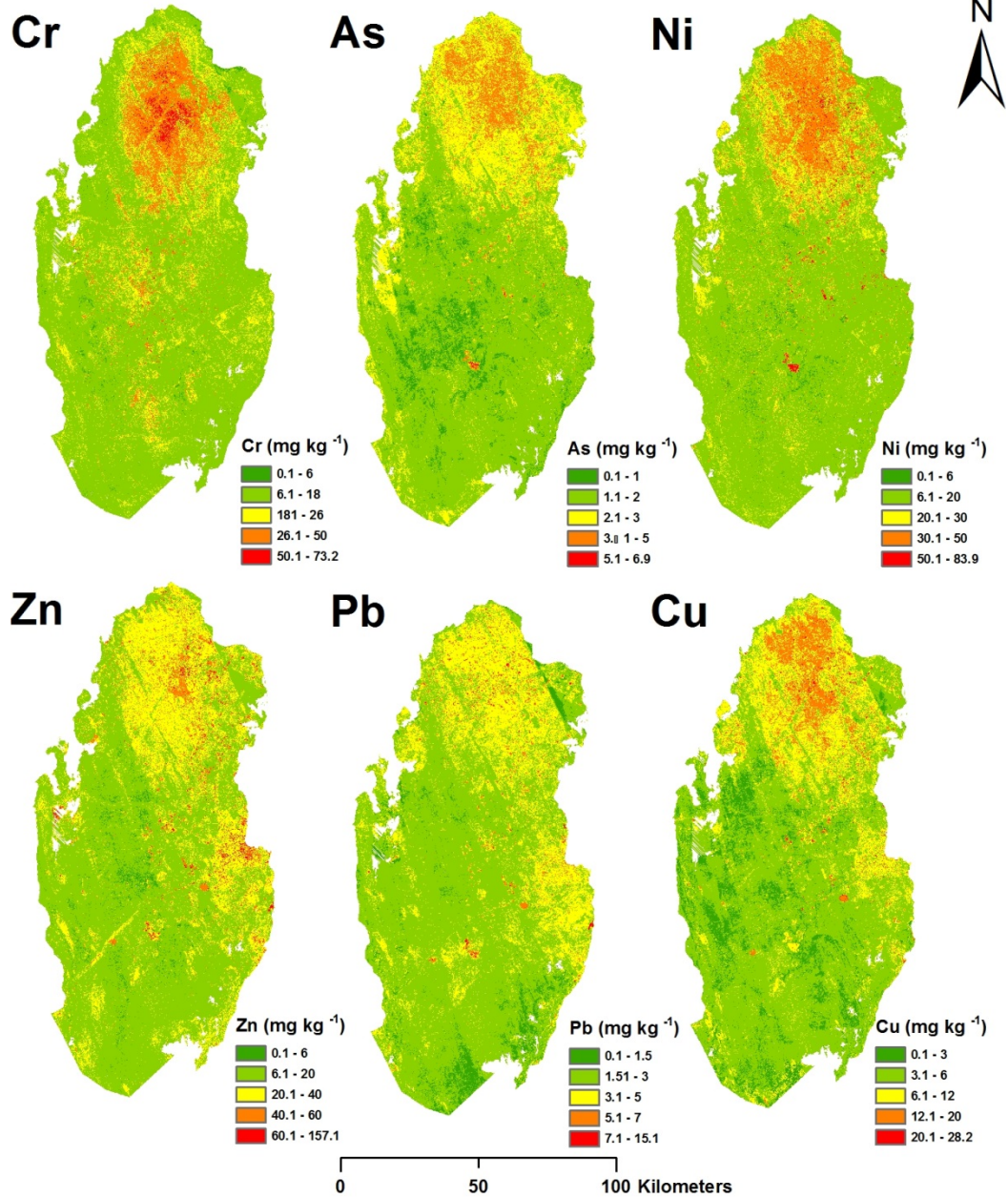
Only images from Jan&Feb
were used for modelling

1. Topography
2. Germination



Red (band4), NIR (band5), Blue (band1) as RGB images

Predicted maps



Conclusions

- Multi-spectral images can be used as an important predictor for large-scale soil heavy metal mapping in arid zone
- Vegetation cover provides important information for soil heavy metal spatial modeling