The UNIVERSITY of OKLAHOMA
Gallogly College of Engineering
School of Civil Engineering and Environmental Science

CREW
Center for Restoration of Ecosystems and Watersheds
University of Oklahoma

A Comparison of Methods for Analyses of Soil Trace Metals in a Mining Impacted Agricultural Watershed

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School of Civil Engineering and Environmental Science

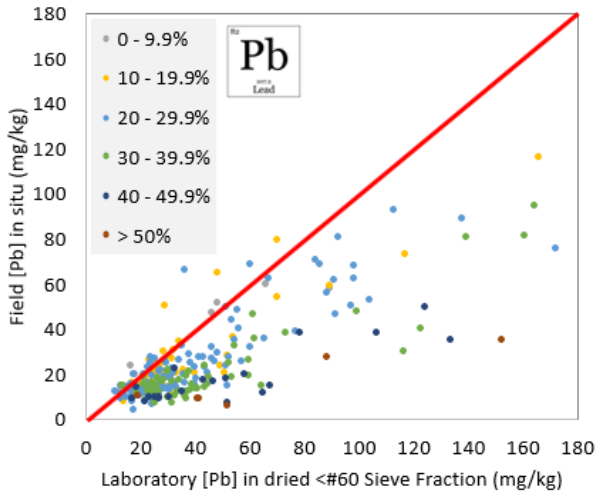
University of Oklahoma

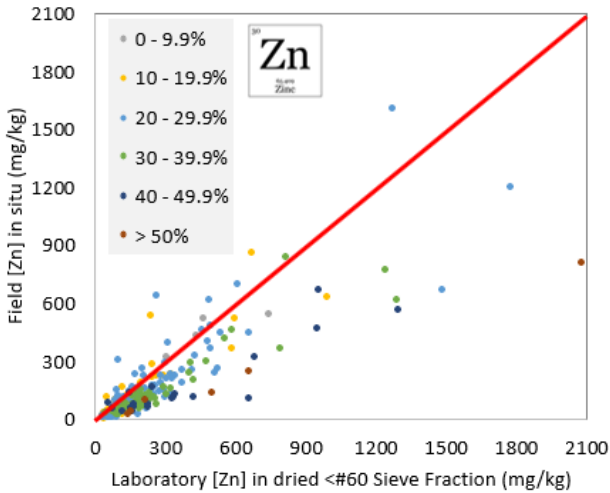
June 5, 2018

Introduction

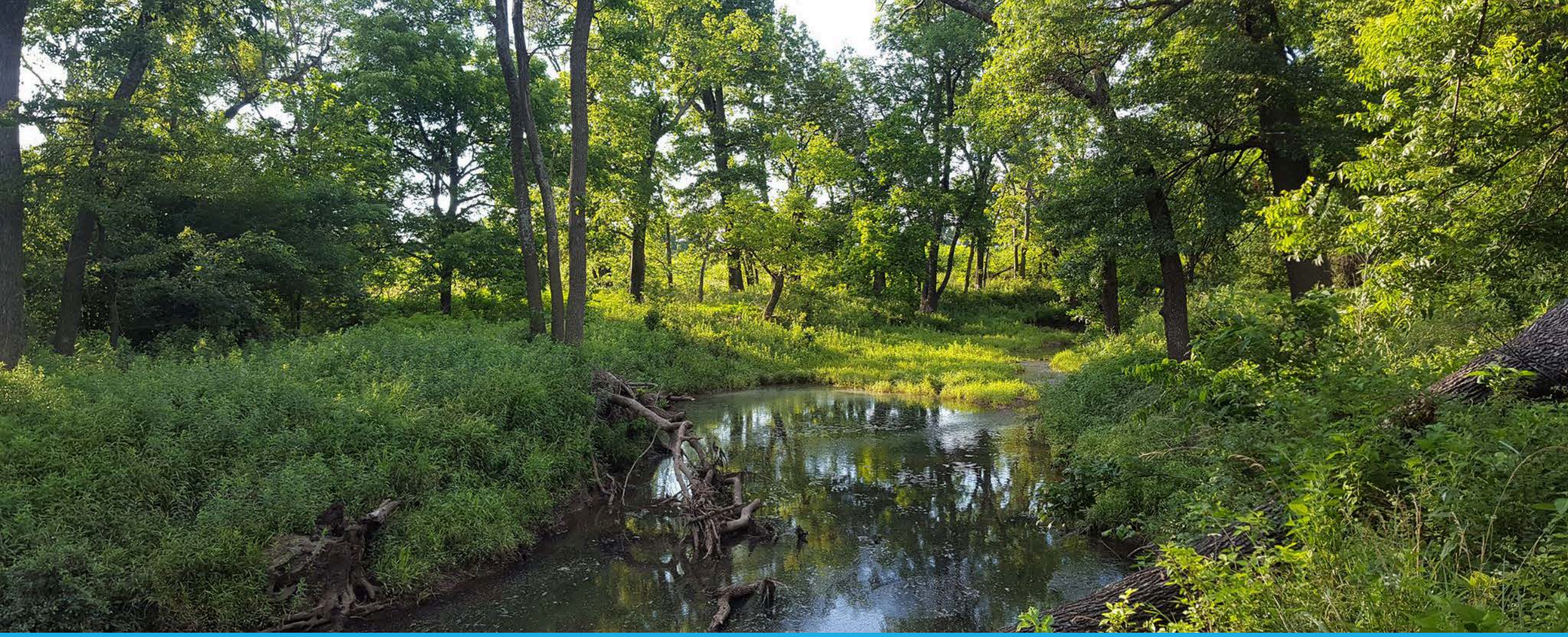
Hypotheses

Methods & Locations





Results & Conclusions



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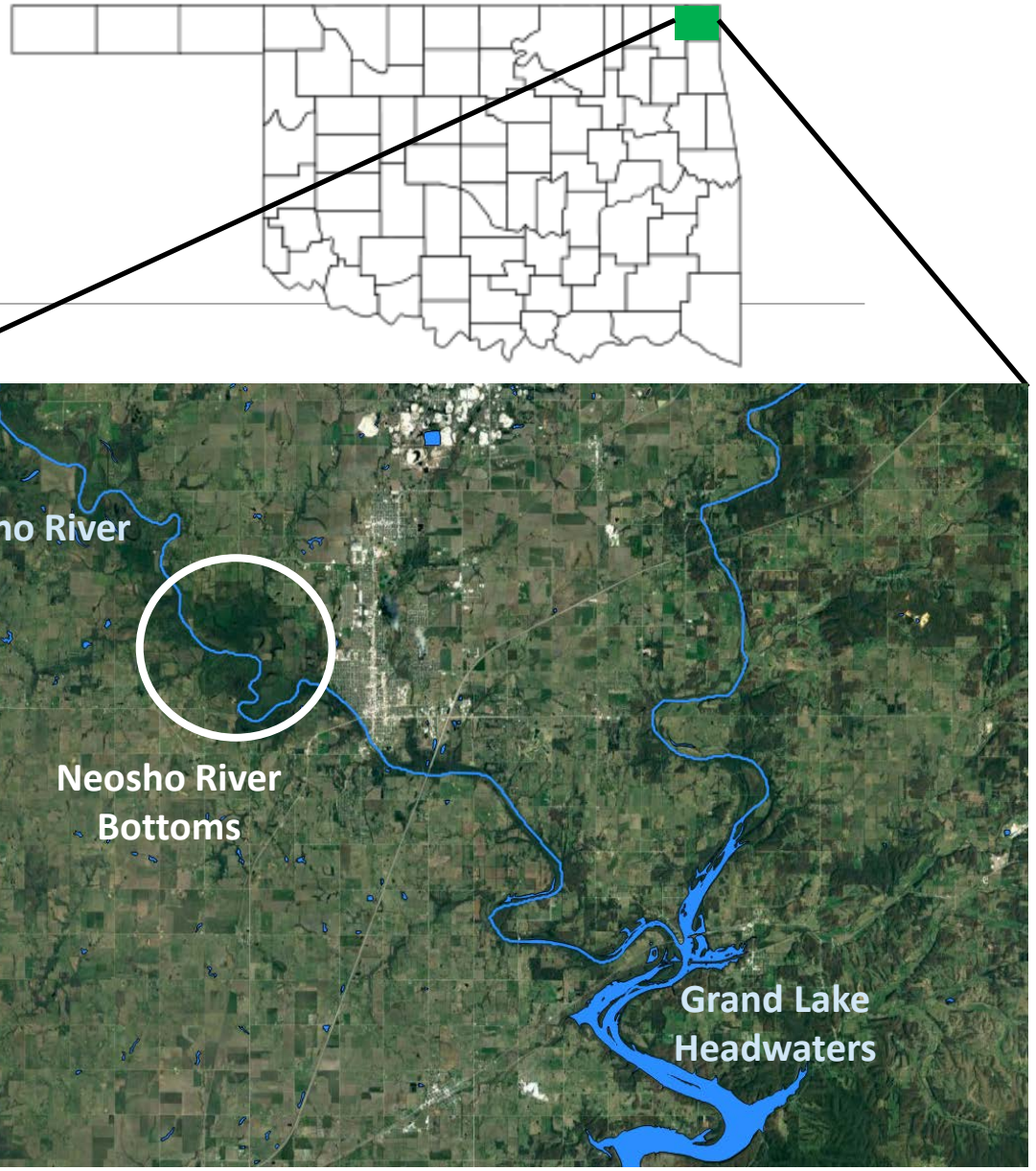
Neosho River Bottoms



- ~25,000 acre floodplain and upland area
- Significant restoration opportunities
  - Bottomland hardwood forest
  - Oxbow lakes
  - Scrub shrub wetland
  - Eastern tall grass prairie
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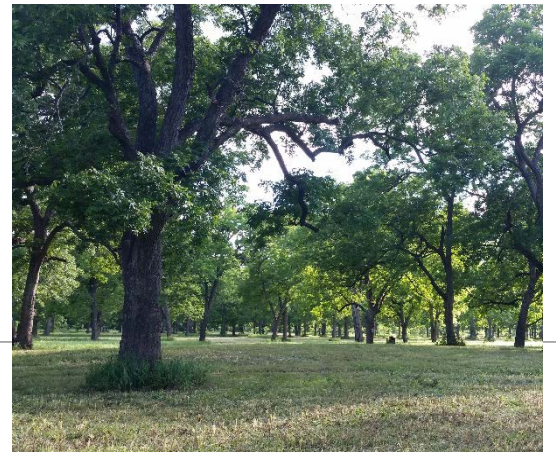
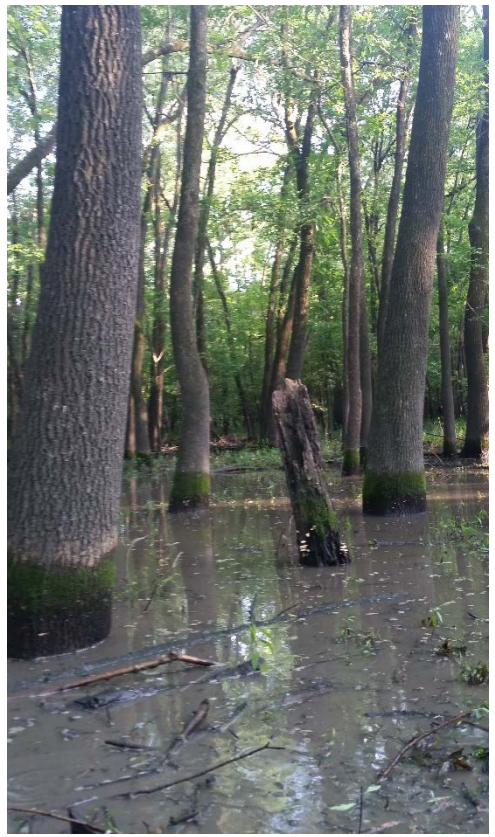
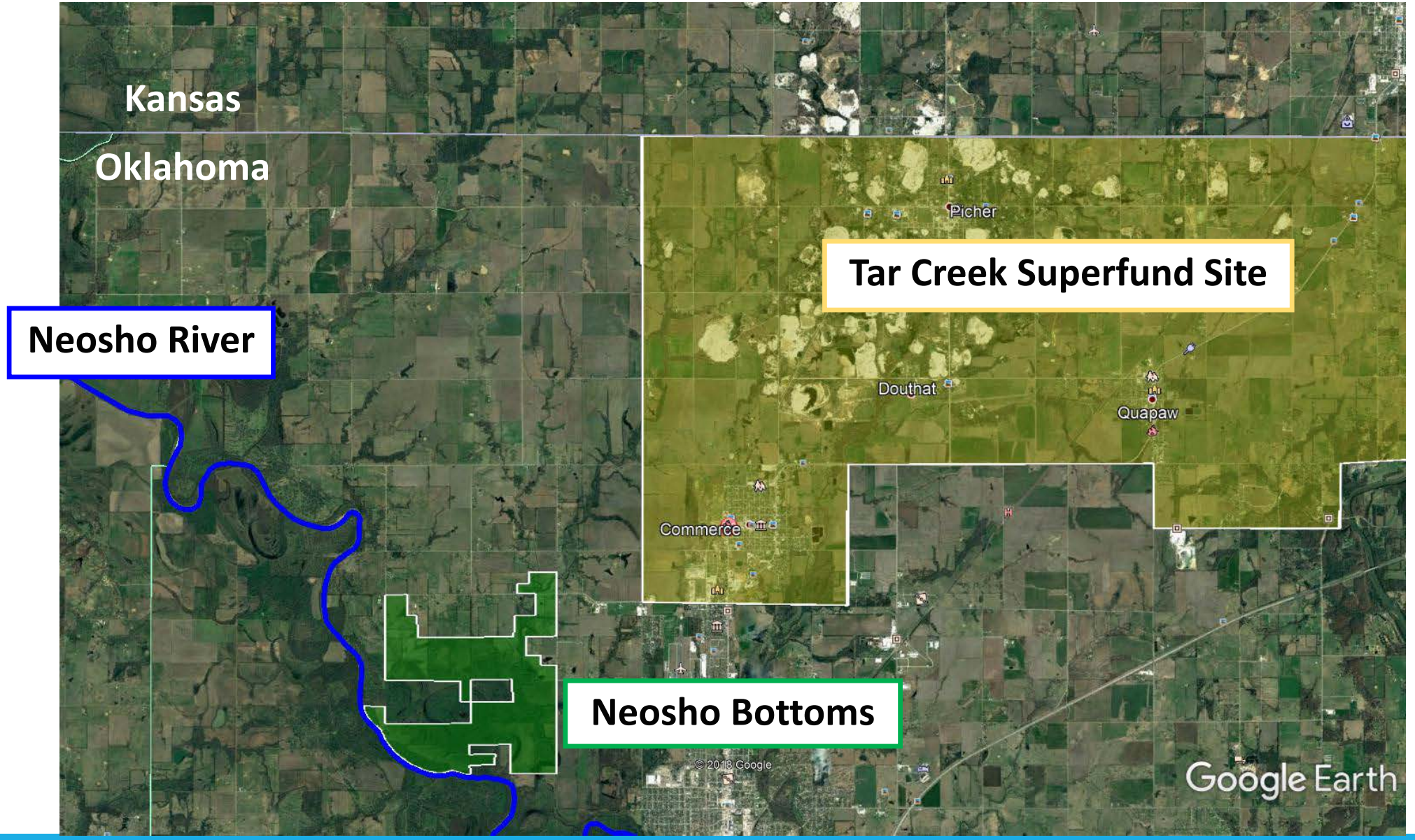




The area of interest south of Superfund Site



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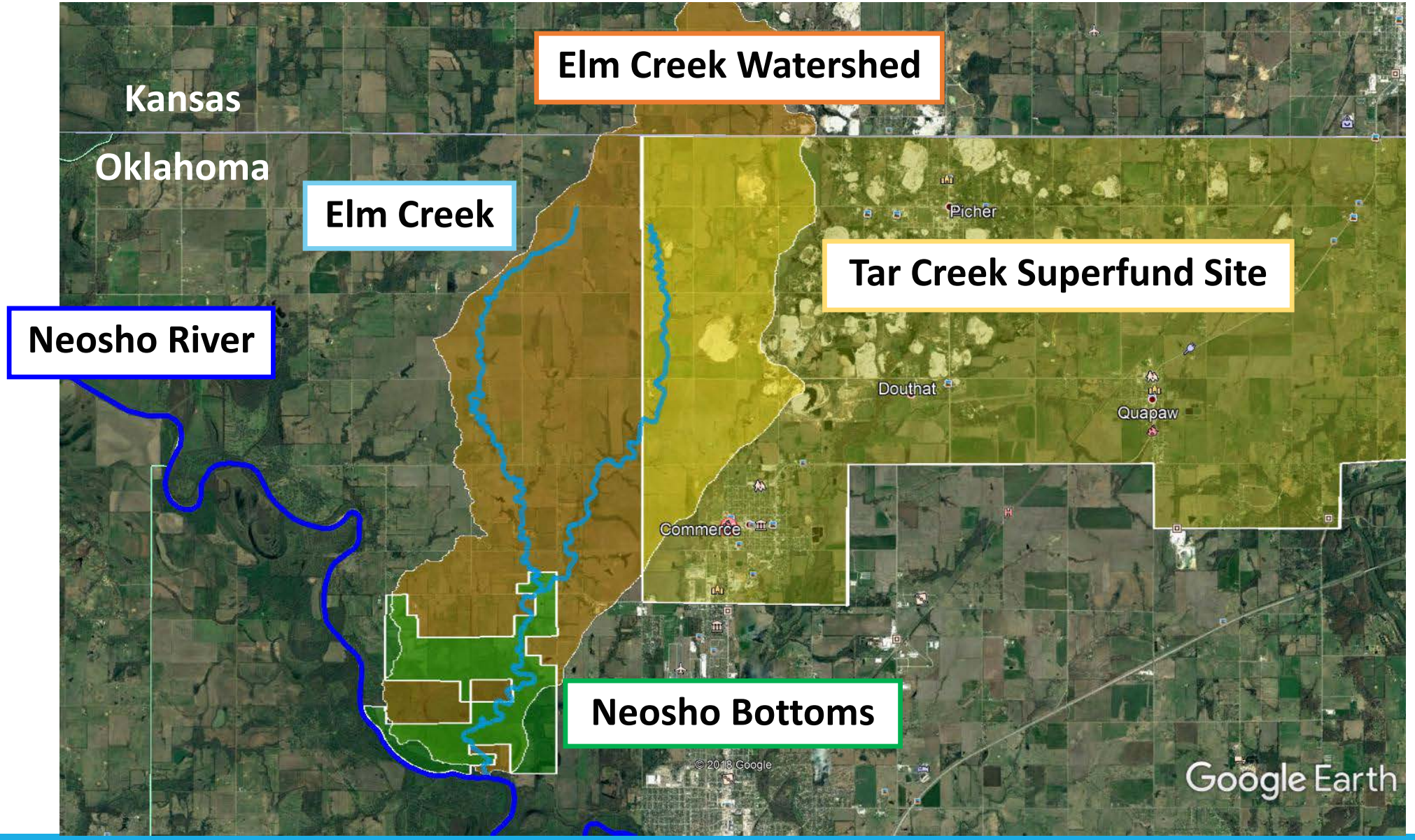

Soil Trace Metals Detection

- Inductively coupled plasma optical emission spectrometry (ICP-OES)
- Inductively coupled plasma mass spectrometry (ICP-MS)
- X-ray fluorescence (XRF)
  - On-site fast screening method for soil metals
  - Cost effective when compared to ICP methods
  - Viewed by the environmental community as an acceptable analytical approach for field applications

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The soil metal concentration in the floodplain were determined three different ways

Method 1:

In Situ

Field Portable XRF Analyses (EPA 6200)
Bulk Sample

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- Soil samples were collected using stainless steel shovel
  - 13 cm X 13 cm X 10 cm cuttings
  - Sealed tightly in 3 mil or thicker plastic bag
- Sample locations were recorded with GPS
- Transported back to laboratory

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Laboratory

Moisture content (ASTM D226-10)
Loss-on-ignition (Dean 1974)

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Dried and < # 60 Sieve Fraction

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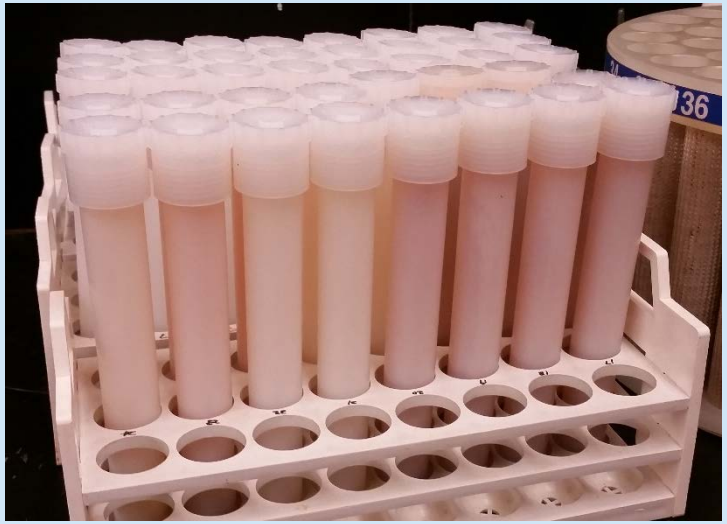

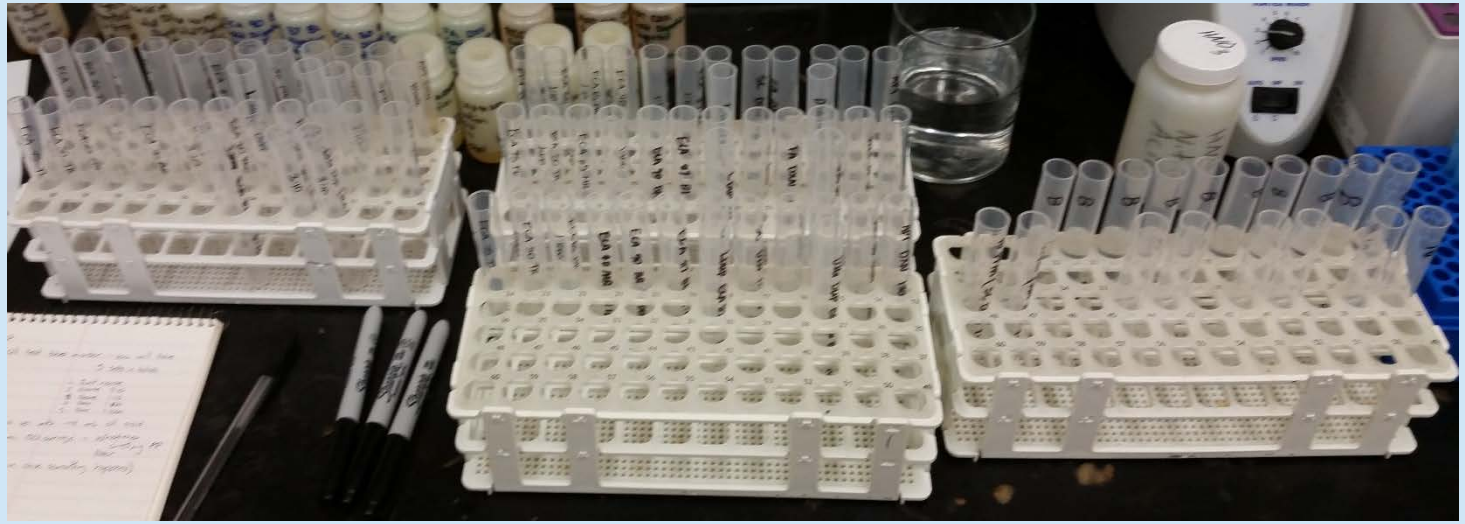

Method 3:

Laboratory

Microwave HNO_3 digestion (EPA 3051)
Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) Analyses (EPA 6010)
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- Elm Creek riparian zone
  - Road crossings (intersecting the stream)
  - GRDA property
  - 106 soil samples
- Neosho Bottoms uplands
  - 278 soil samples

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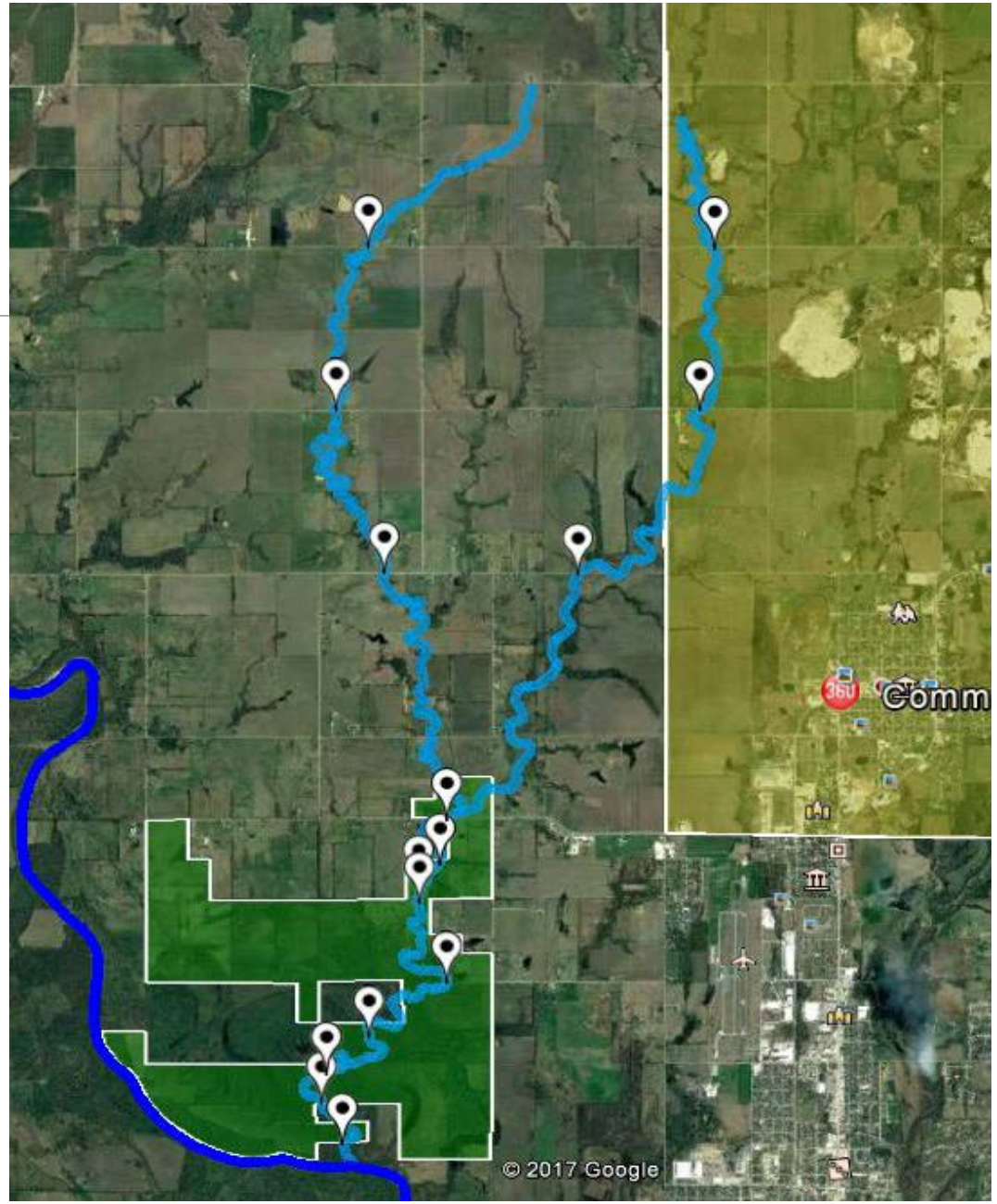

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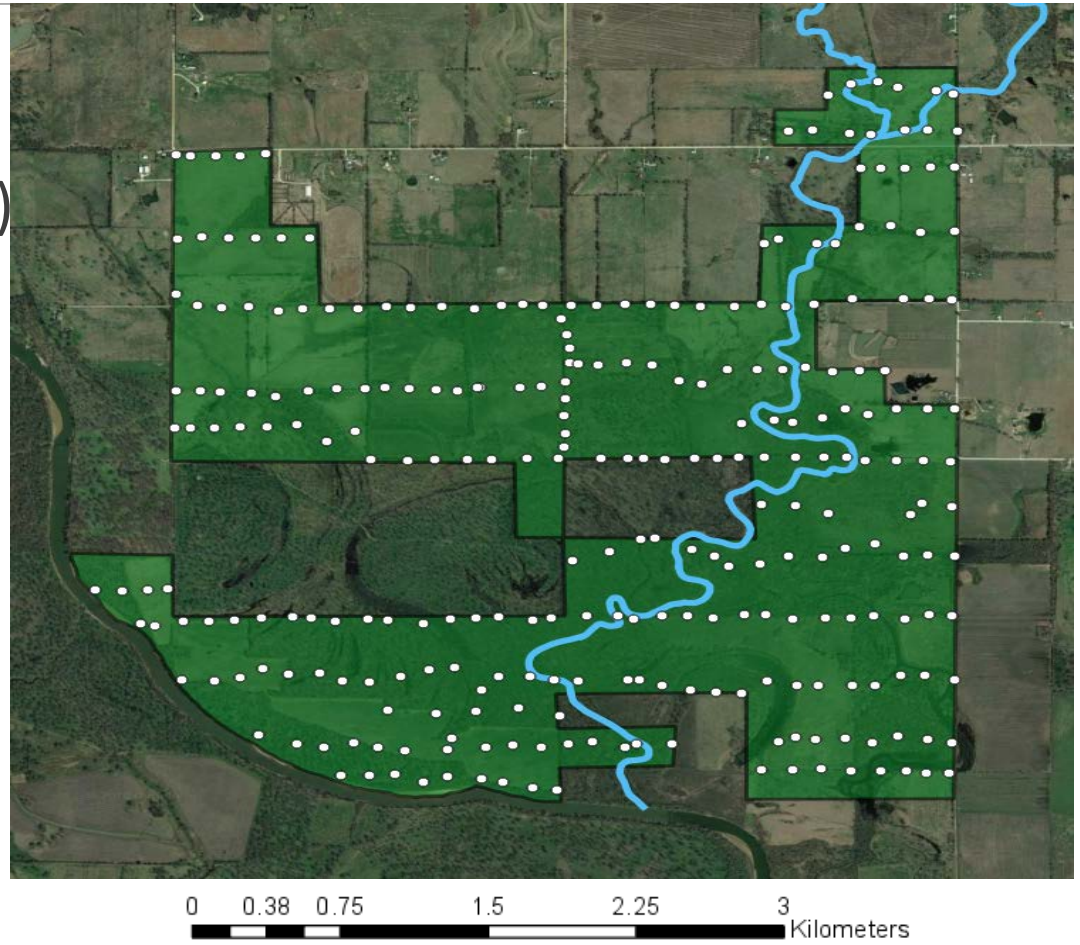

Results & Conclusions

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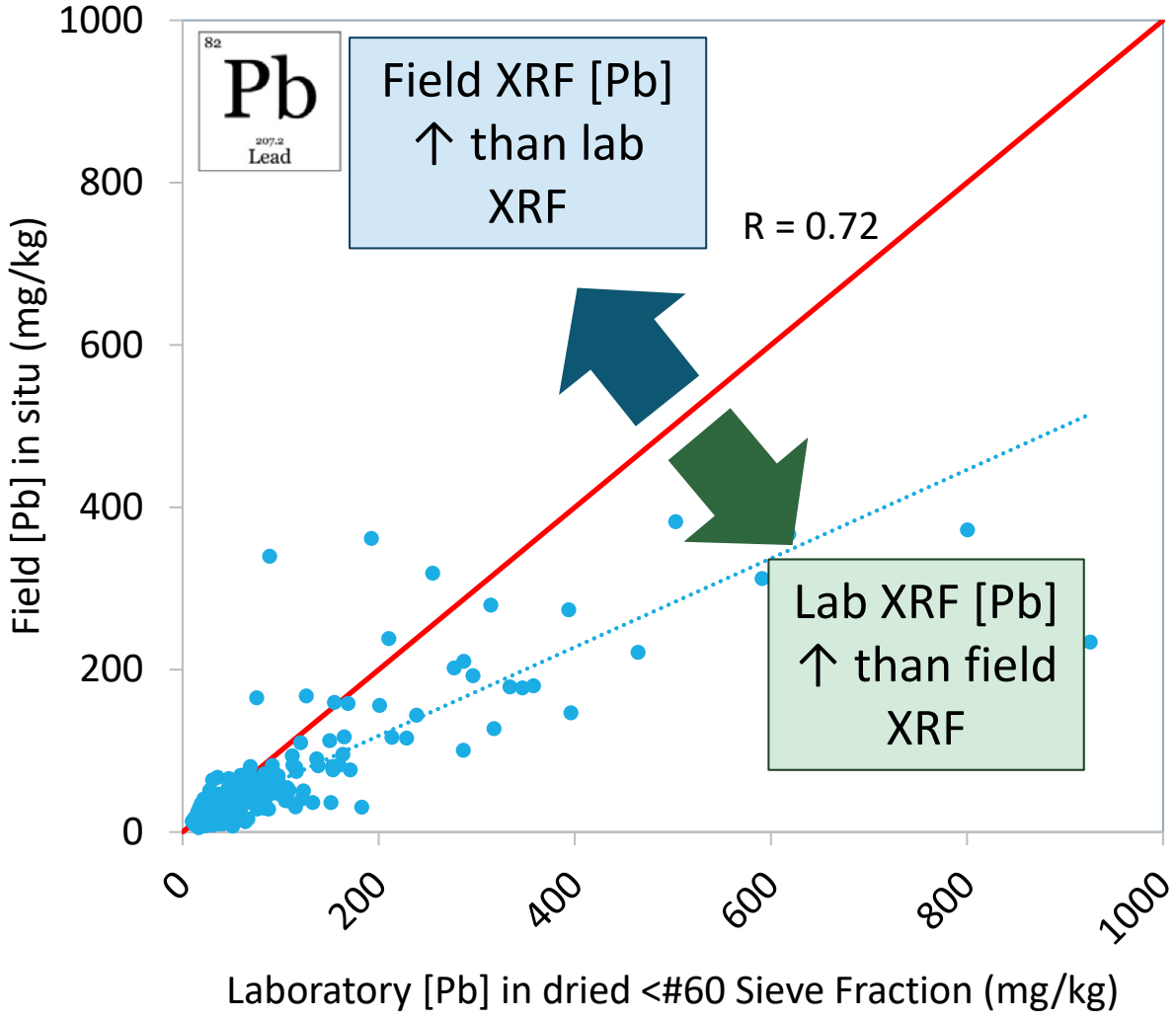

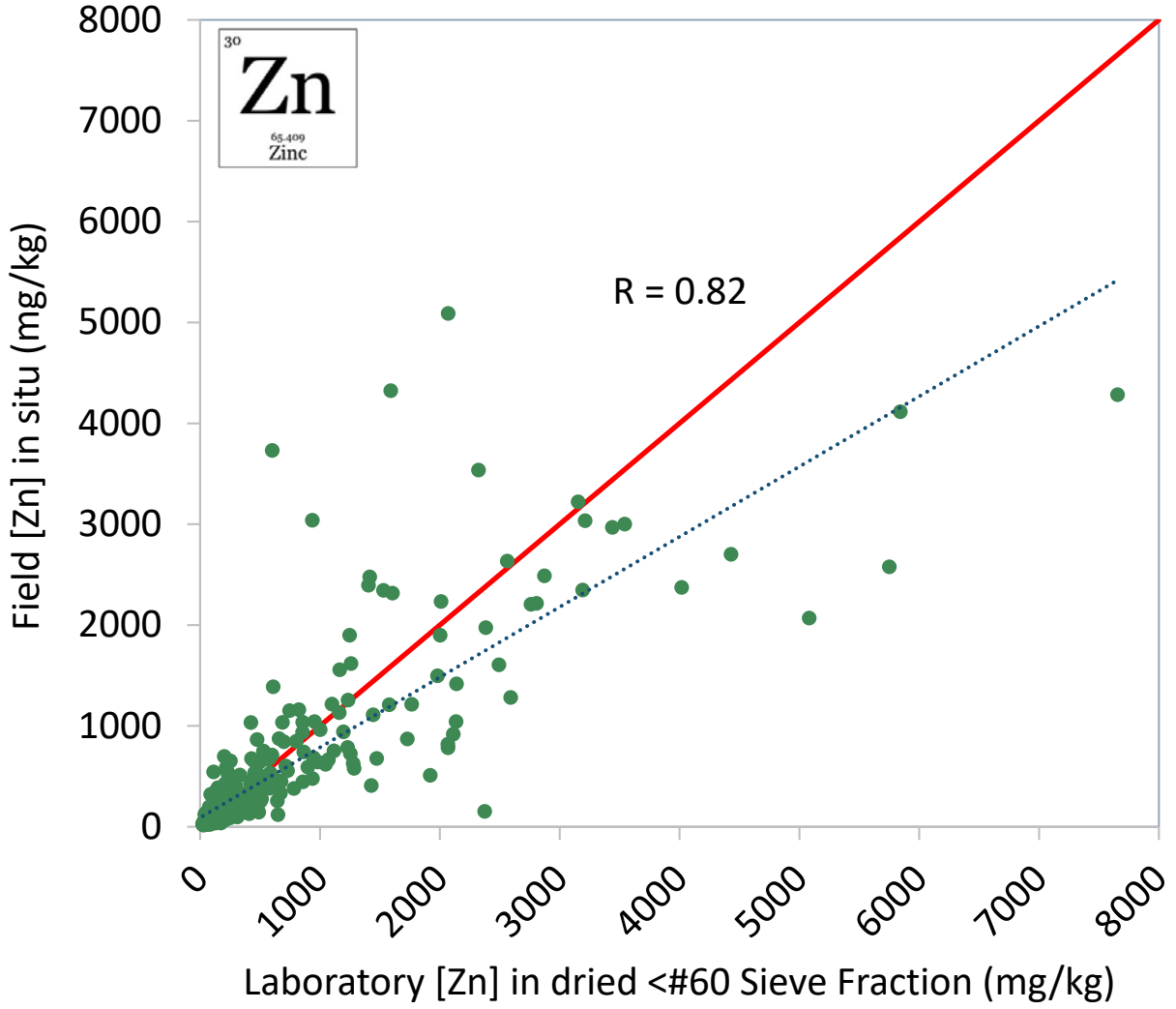

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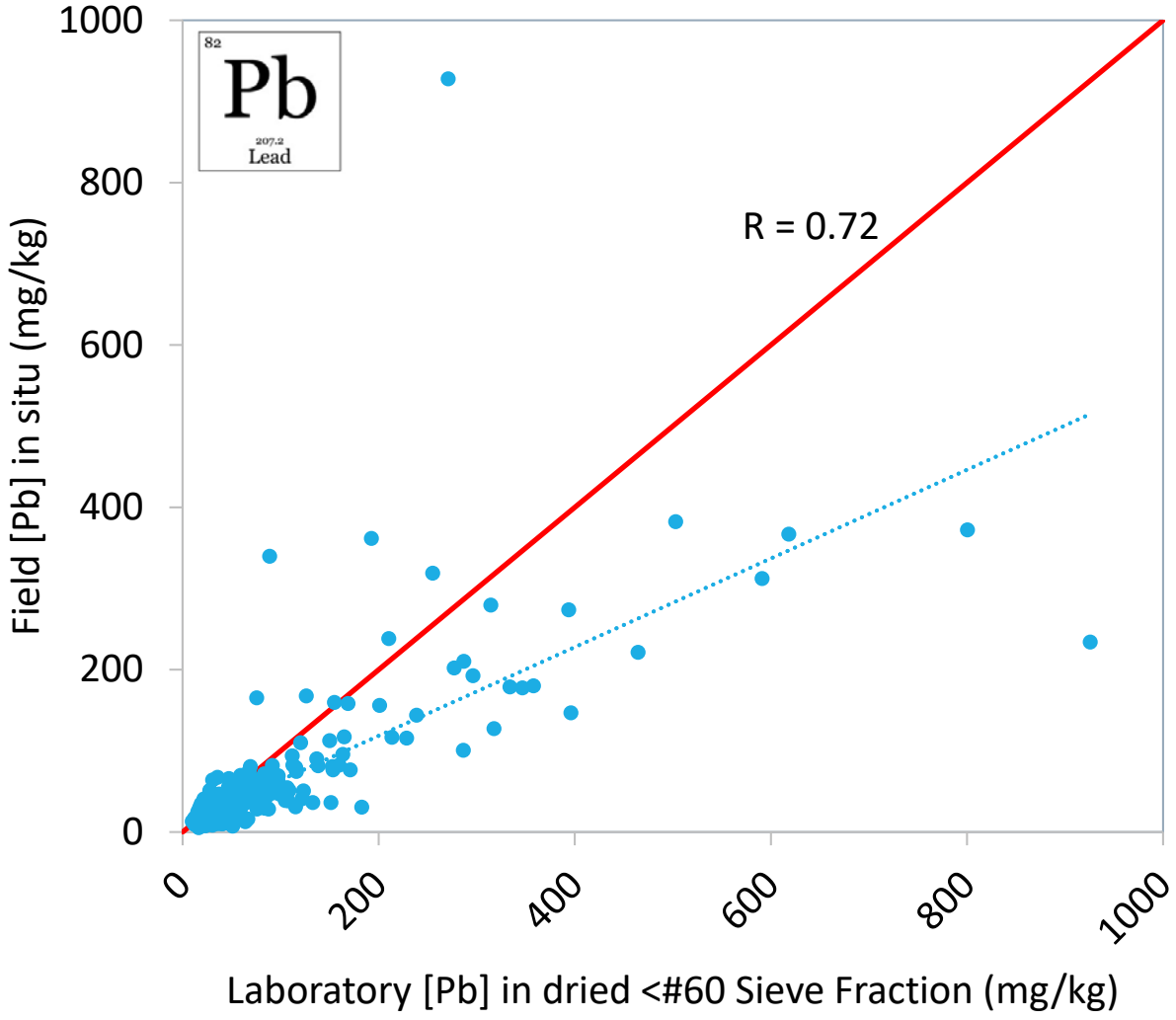
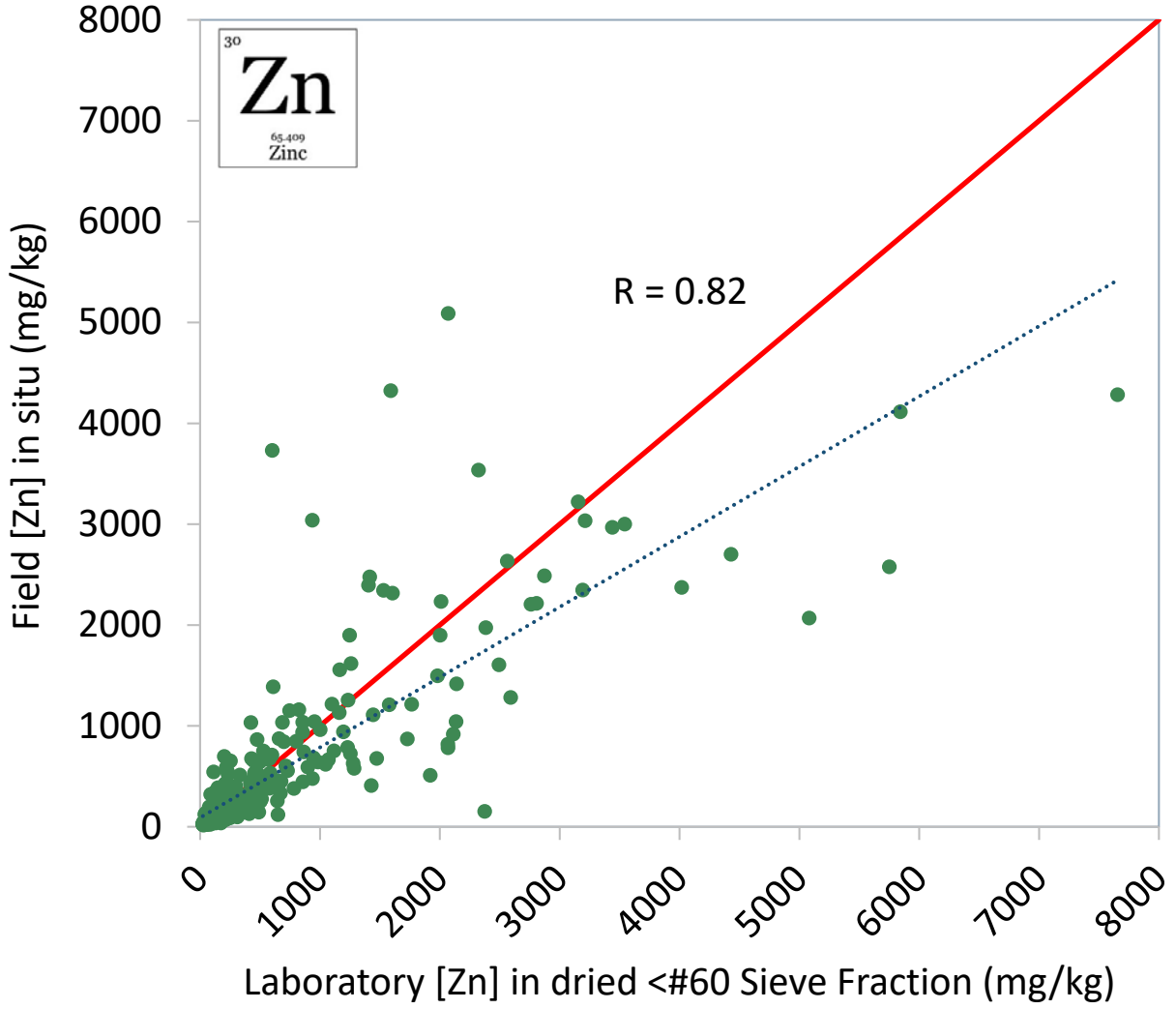
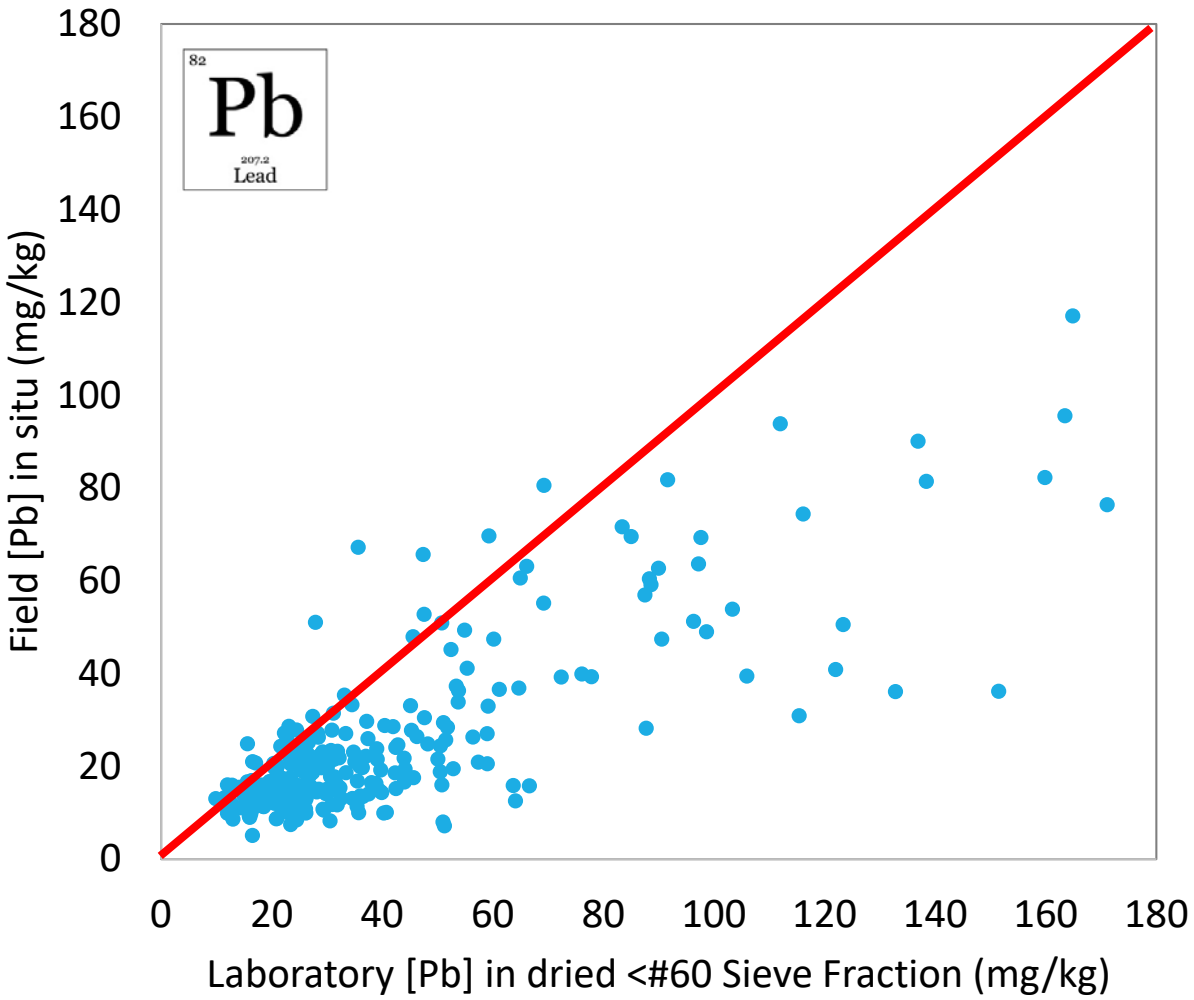
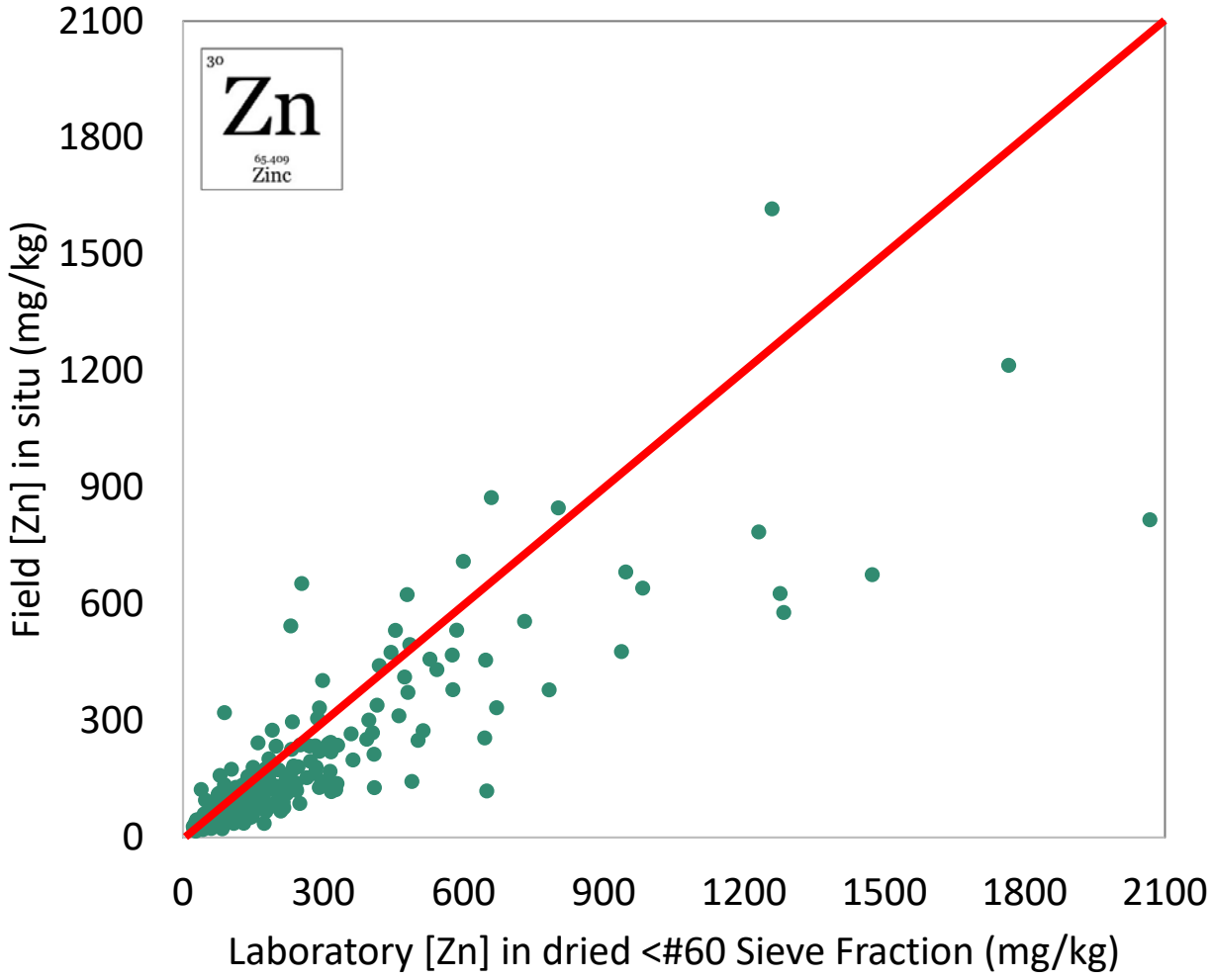




Relation Between Upland Field and Laboratory XRF Concentrations





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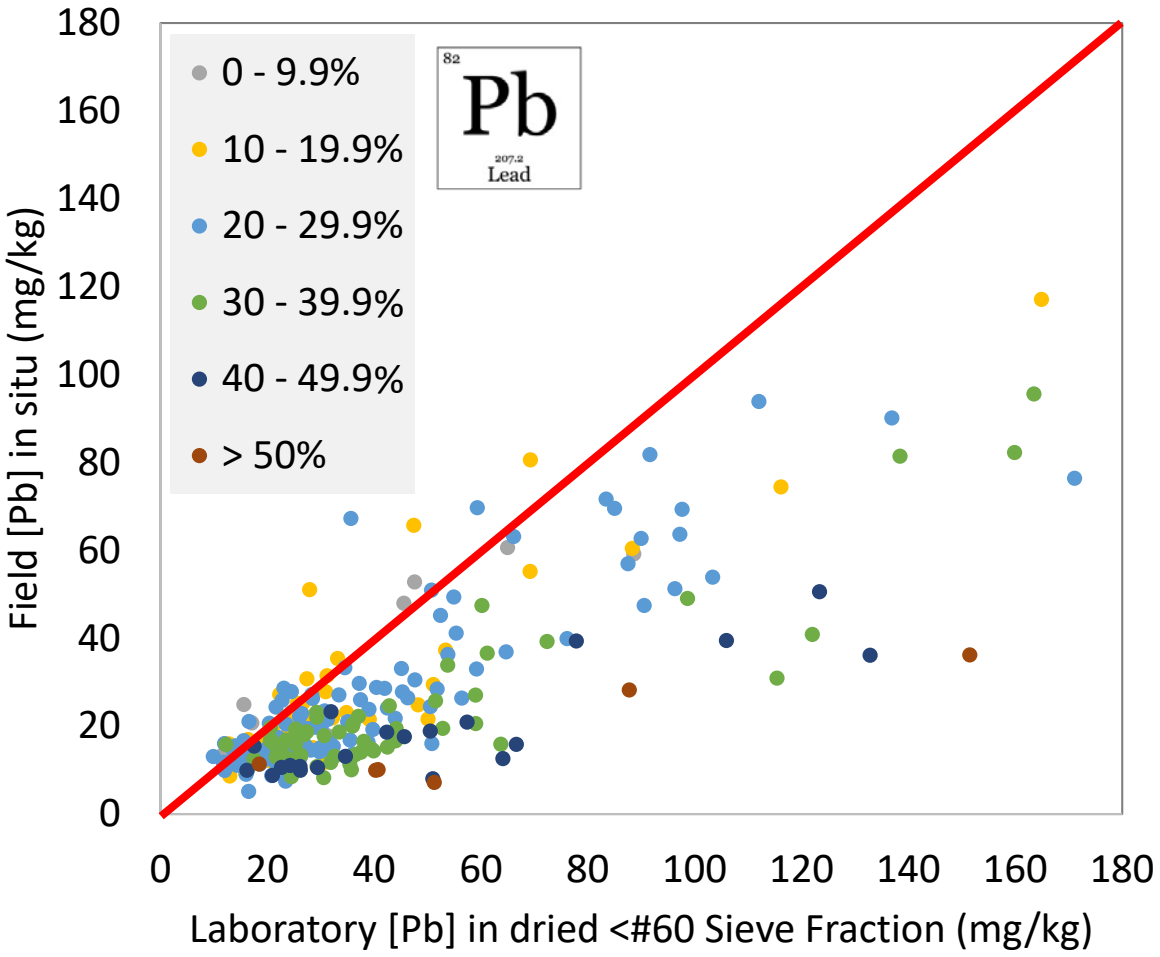

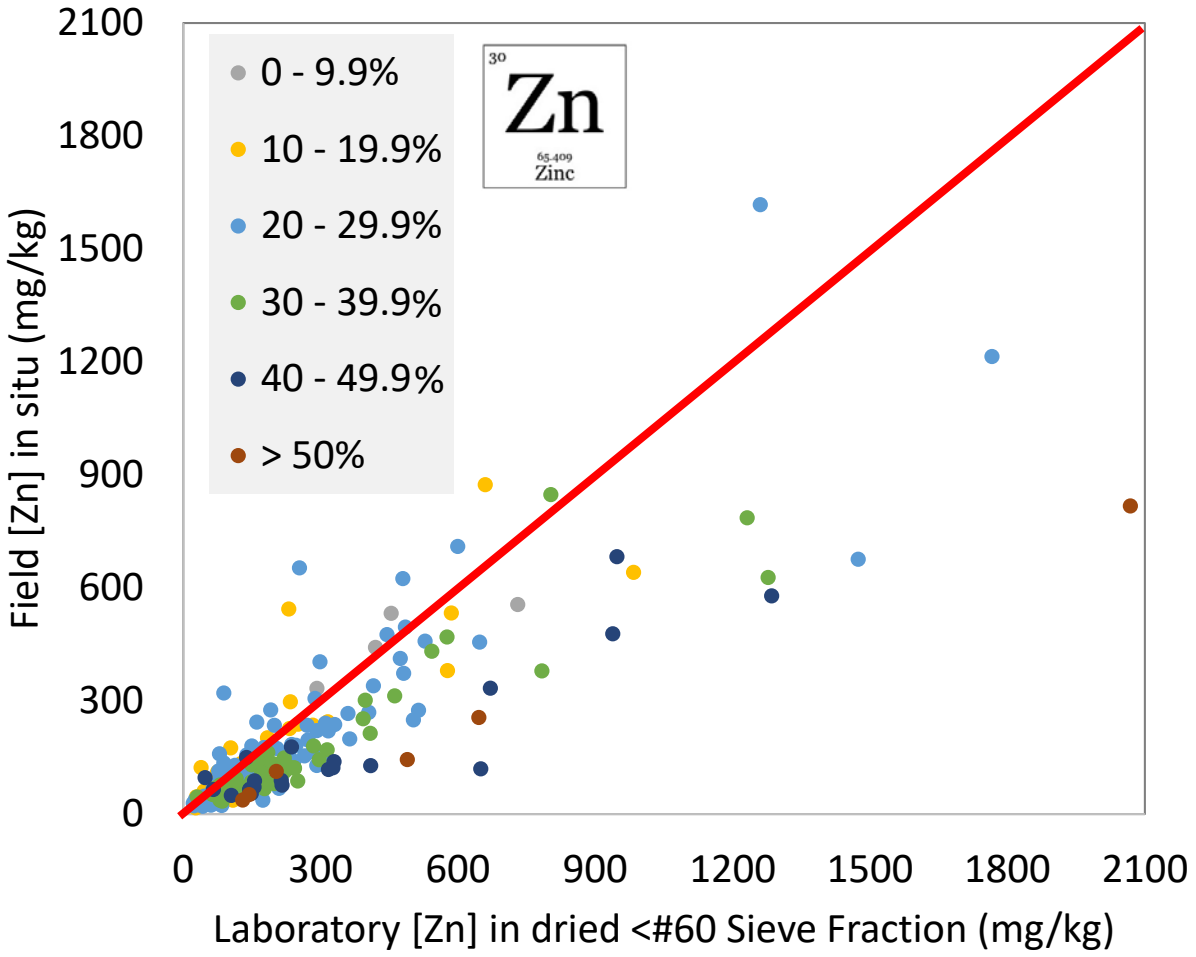

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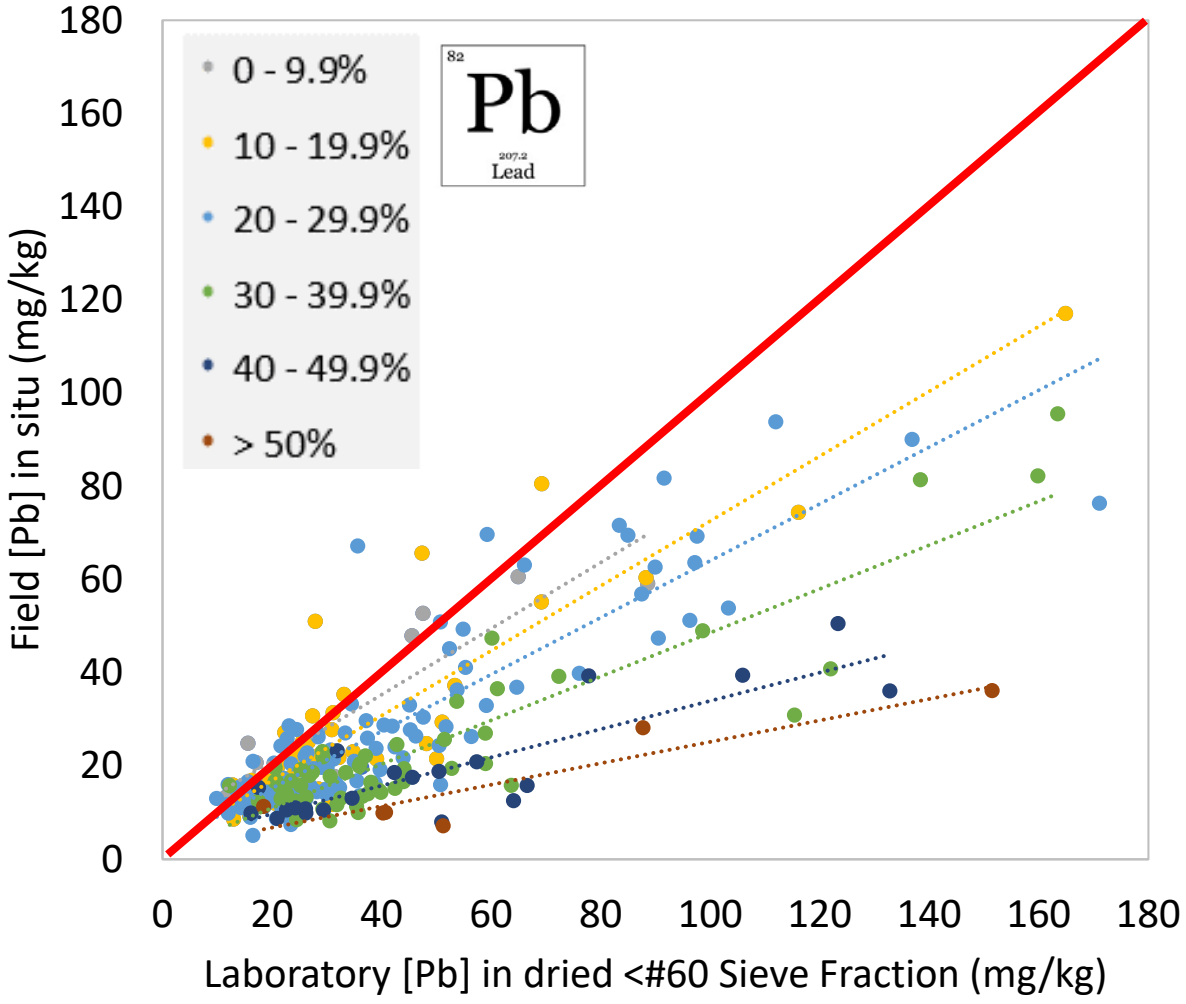
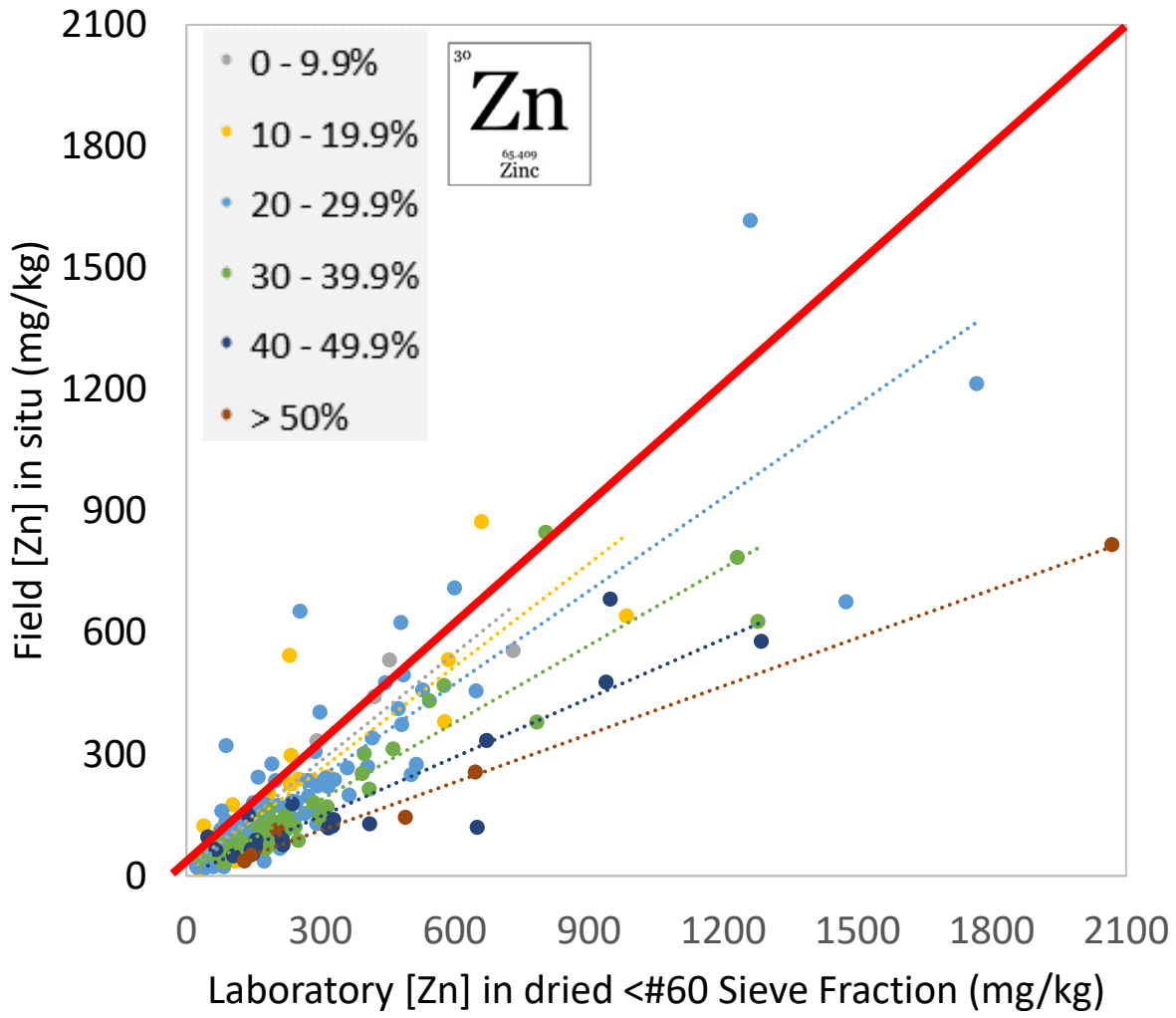
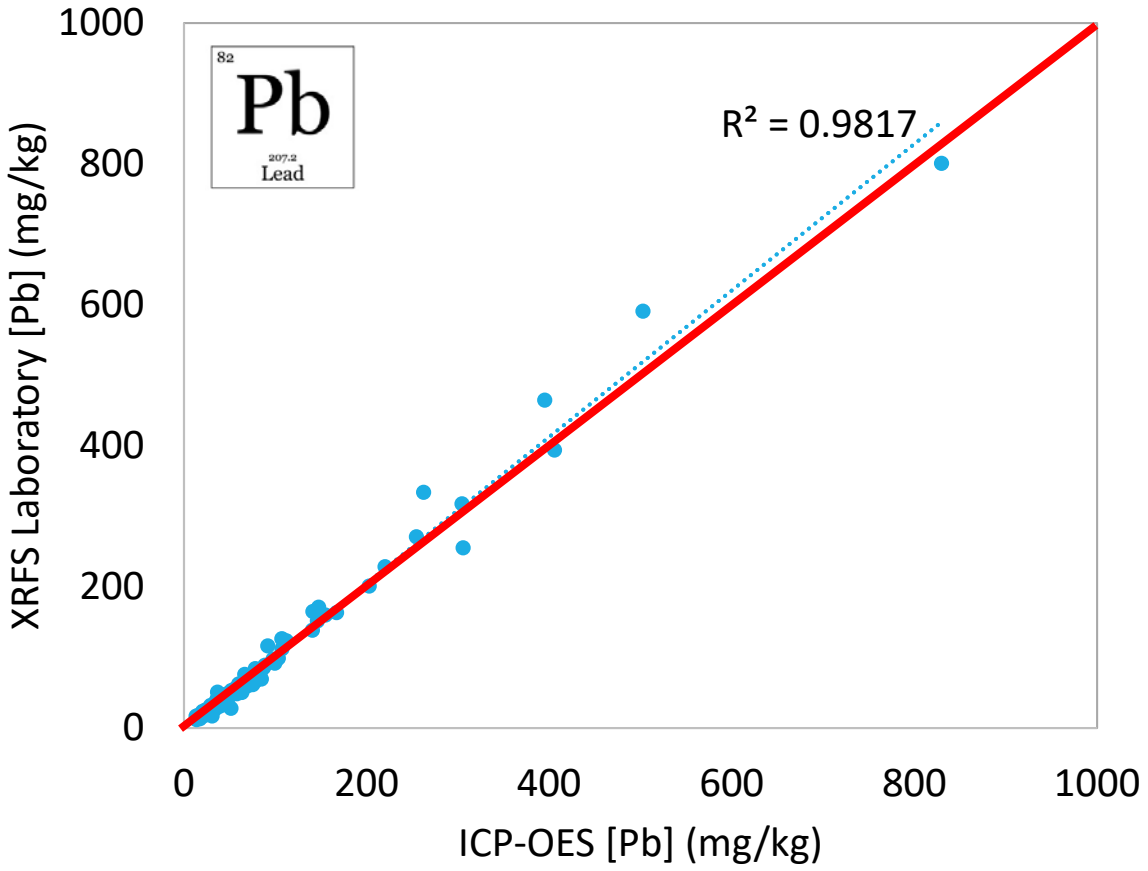
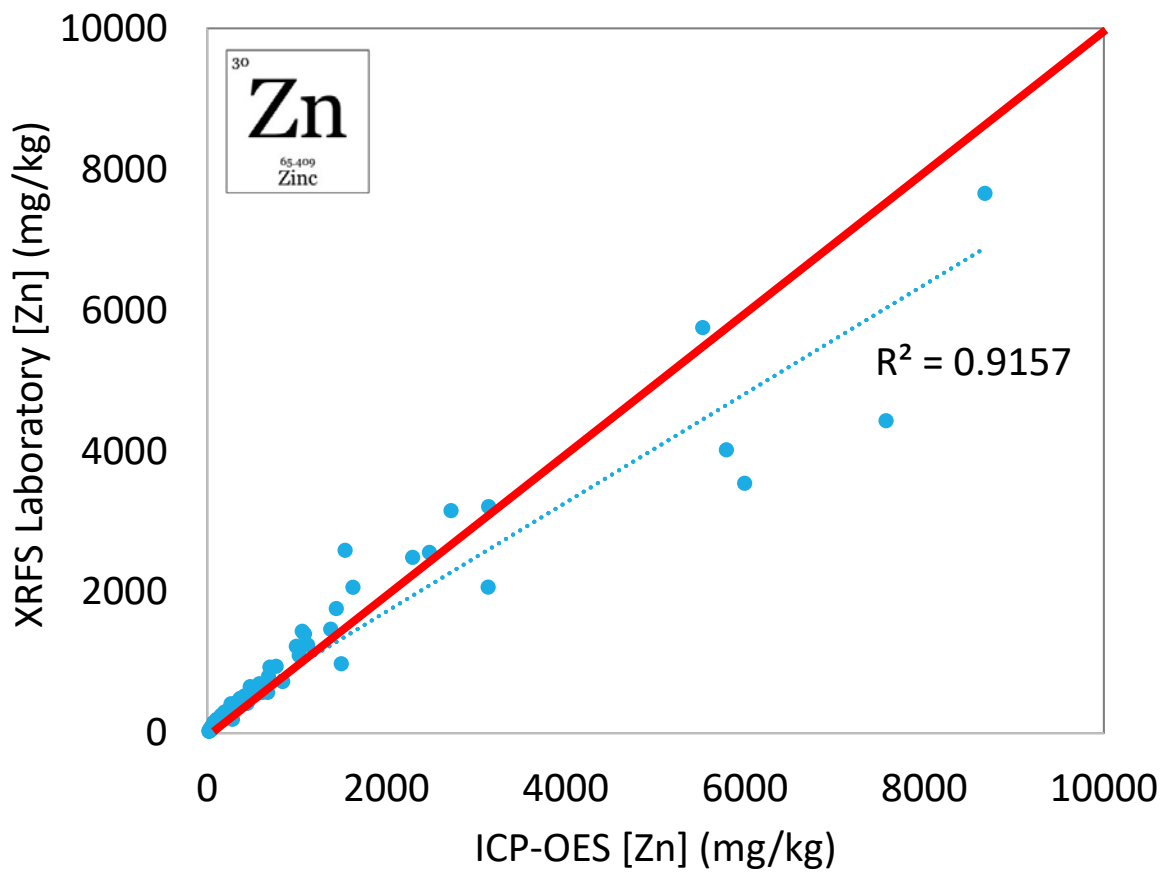


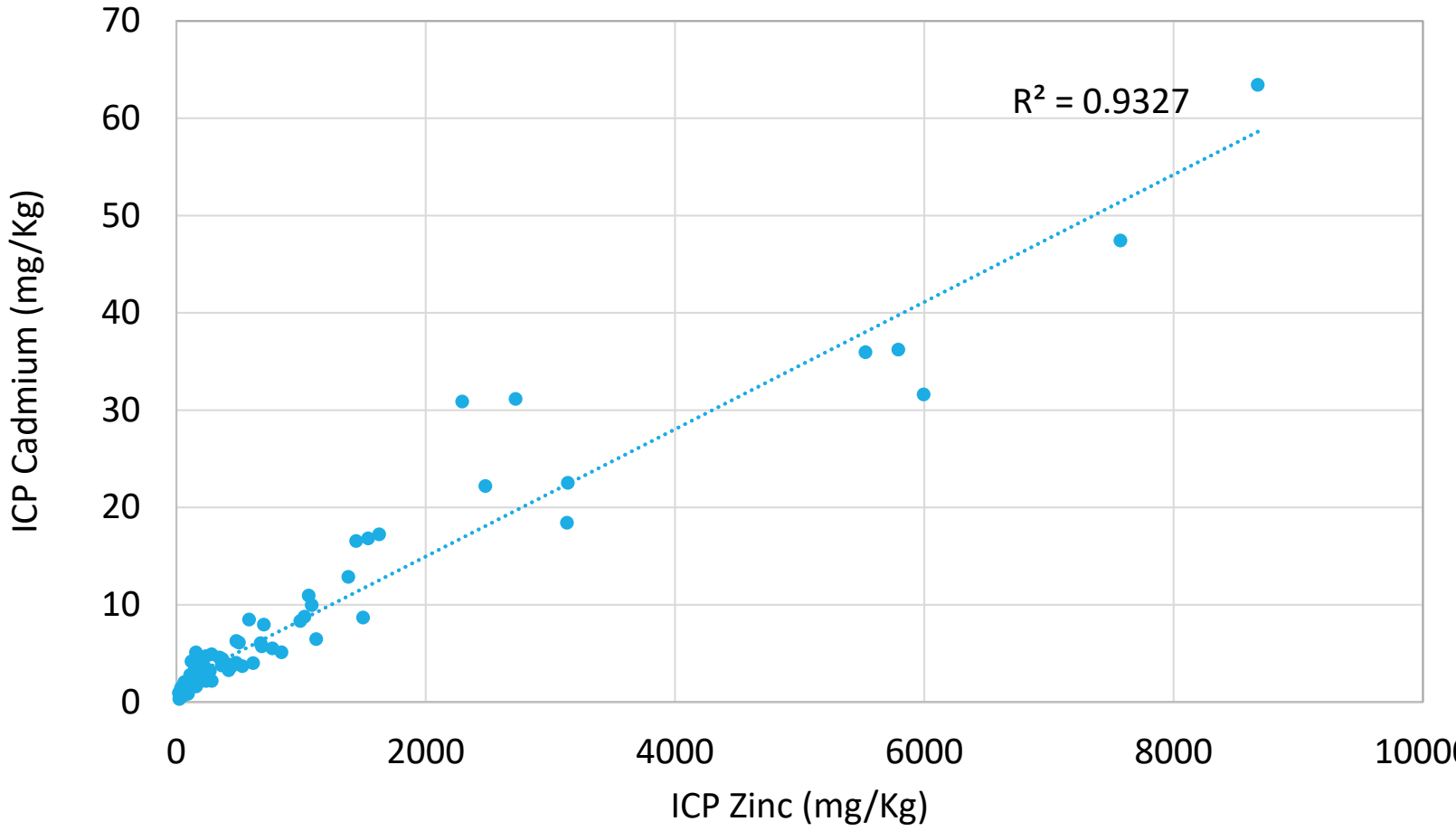


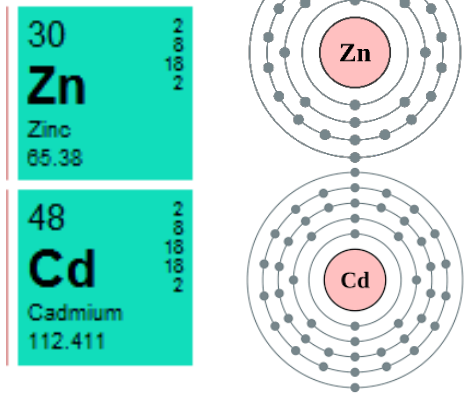
Pb and Zn Laboratory XRFS v. ICP





ICP Cadmium v. Zinc





Organic Matter Analysis

- Lead XRFS and ICP concentrations:
  - Statistically similar for OM >10%
  - Statistically different for OM <10%

- Zinc statistically different for both OM ranges

Conclusions

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Acknowledgements

- GRDA grant #1053733
- Aaron Roper, GRDA
- OU CREW
  - Thank you to everyone who helped with field sampling, laboratory analysis, and data reduction!
- Darren Shepherd
- Lane Maguire

Questions?