



The influence of metals from stormwater outfalls on sediment denitrification in Johnson Creek, OR

J.L. Morse¹, D. Allen², R. Terrell³, S. Arthur², J. Mant³, J.A. Yeakley¹, C. Thorne⁴

¹Portland State University, Portland, OR, USA

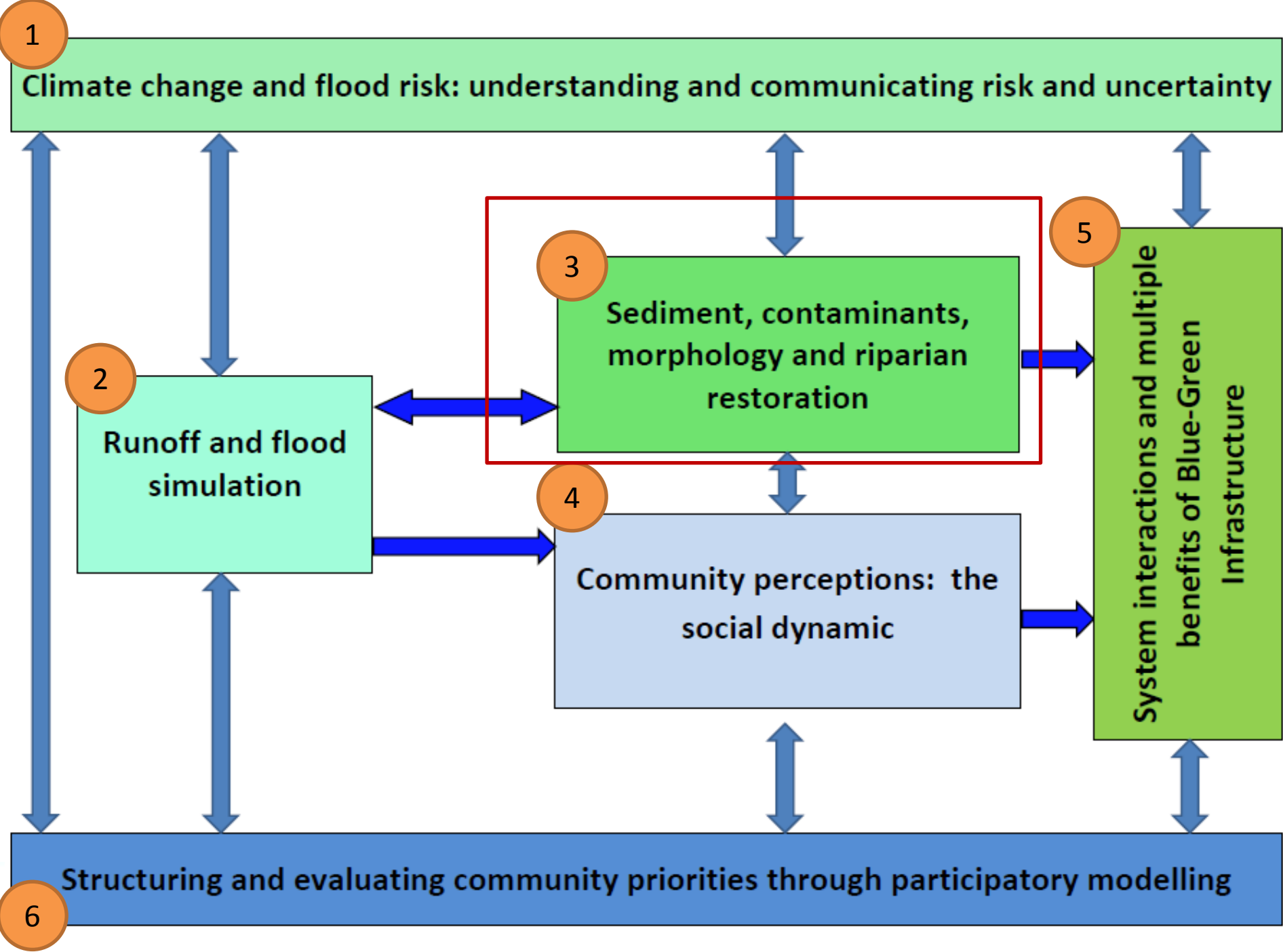
²Herriot-Watt University, Edinburgh, Scotland, UK

³Cranfield University, Cranfield, England, UK

⁴University of Nottingham, Nottingham, England, UK

21 May 2015

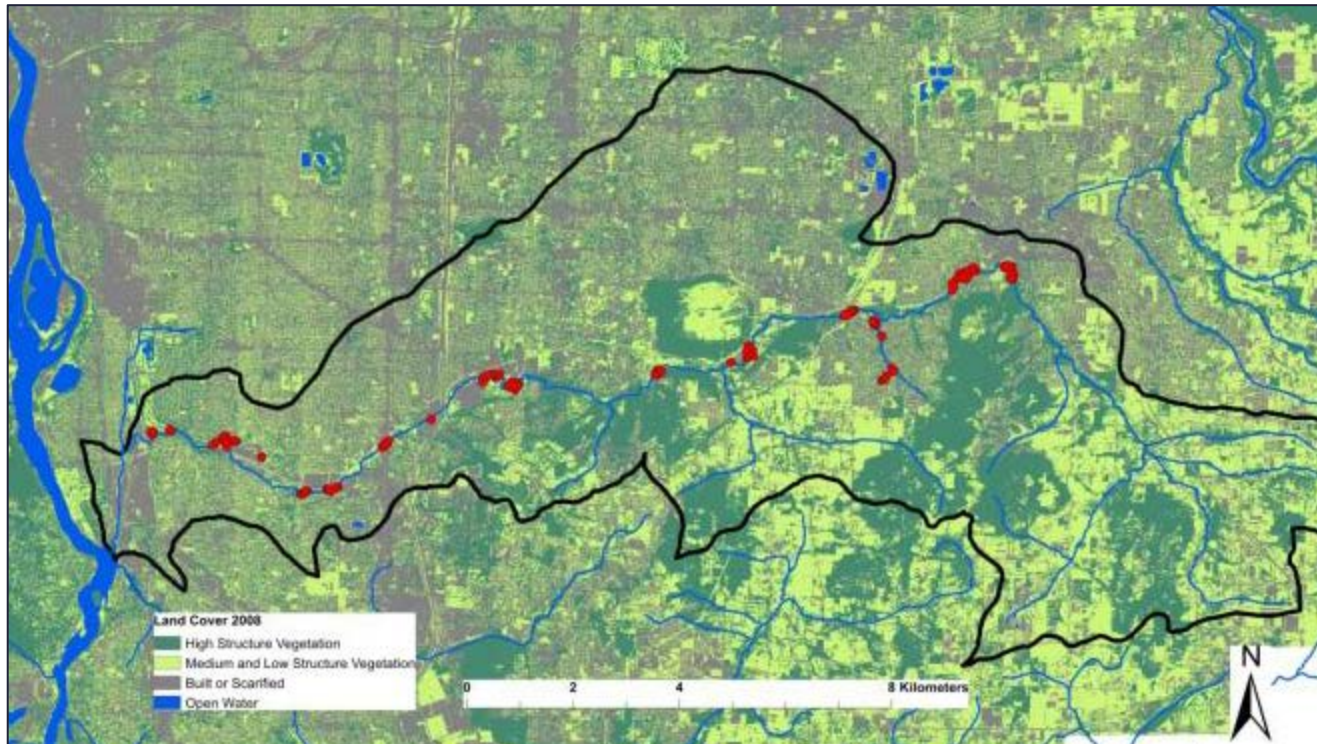
Johnson Creek Science Symposium



CWFA 3. The influence of green infrastructure and river restoration on river health and water quality

1. How does green stormwater infrastructure influence riparian habitat and water quality?
2. What influence does river restoration have on riparian habitat and water quality?

Urban
(high
impervious
cover)



Rural
(low
impervious
cover)



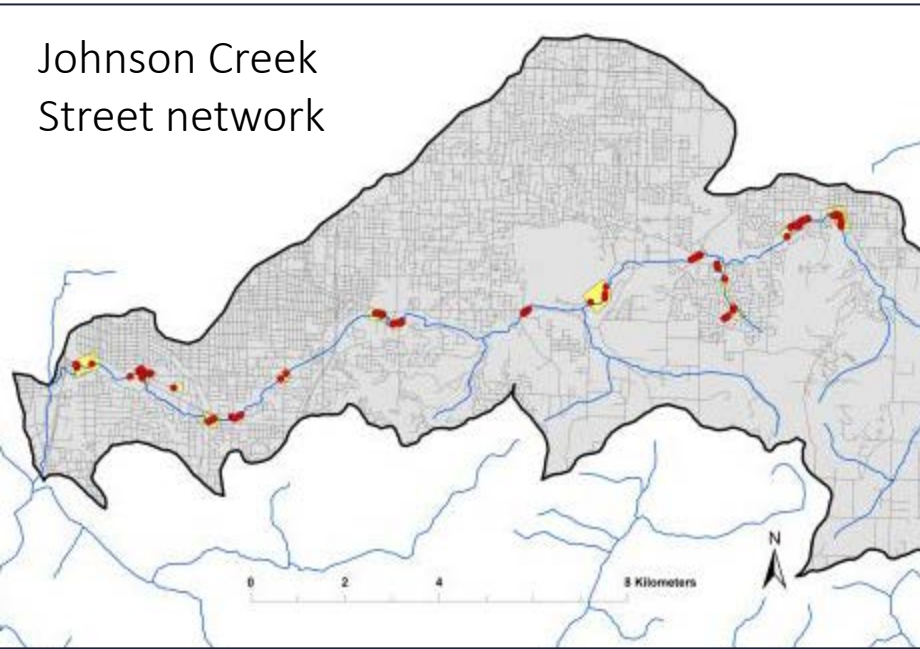
Biogeochemistry Research Questions

1. Are there hot spots of metal contaminants from stormwater outfalls in Johnson Creek?
2. What are the relationships between sediment metal concentrations and microbial activity, including denitrification?
3. Are there patterns in sediment biogeochemistry as a function of catchment land use, management approach (Blue-Green infrastructure), and spatial configuration?



Sample Collection

Johnson Creek
Street network

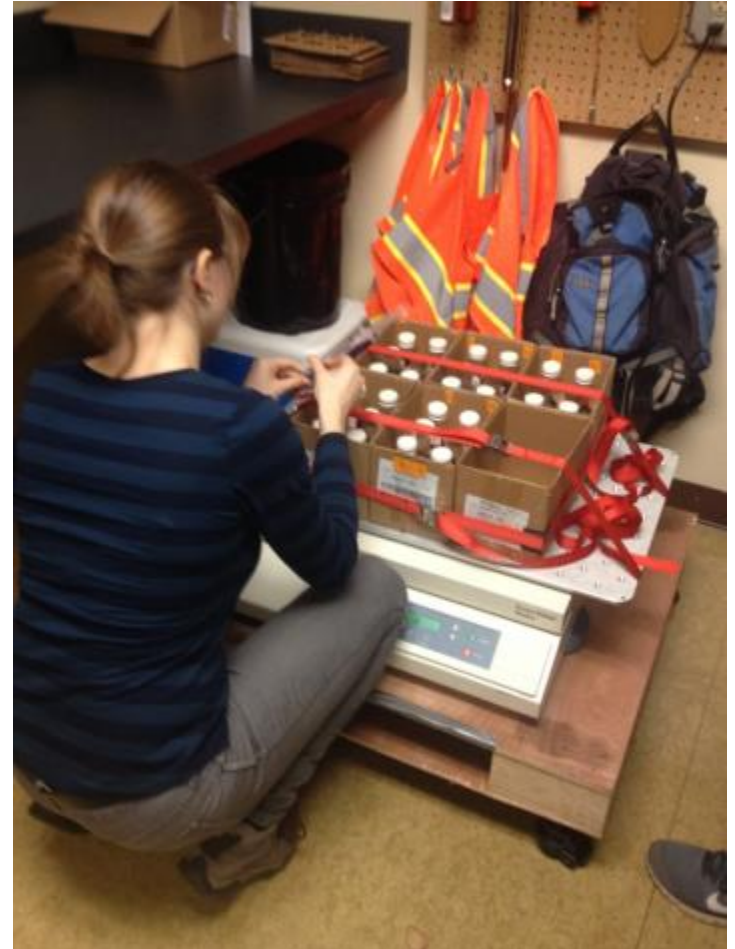


- 45 outfalls in 18 reaches
- Downstream and upstream of each outfall
- Rapid habitat assessment
- Surface sediments collected (181 samples)

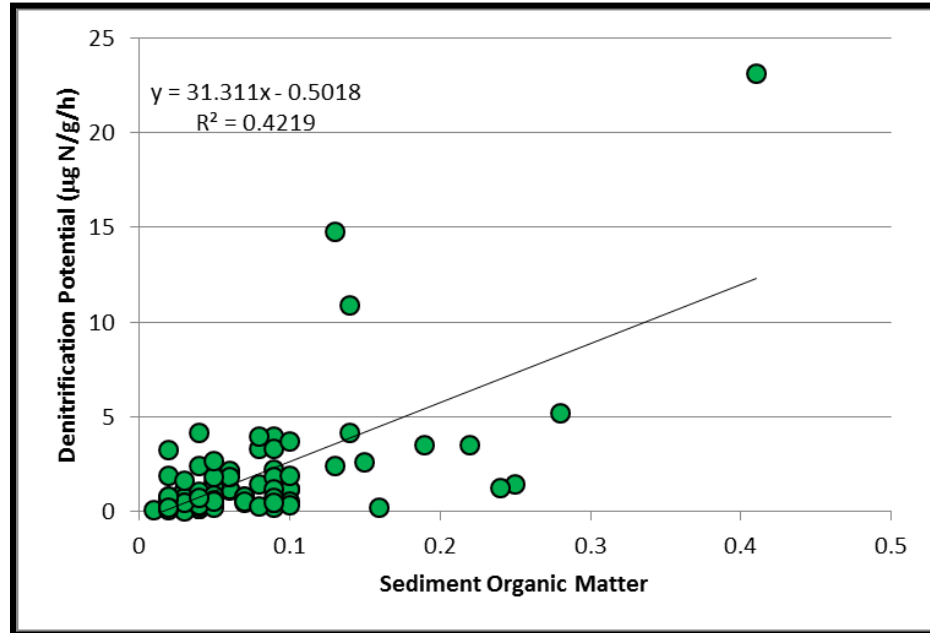
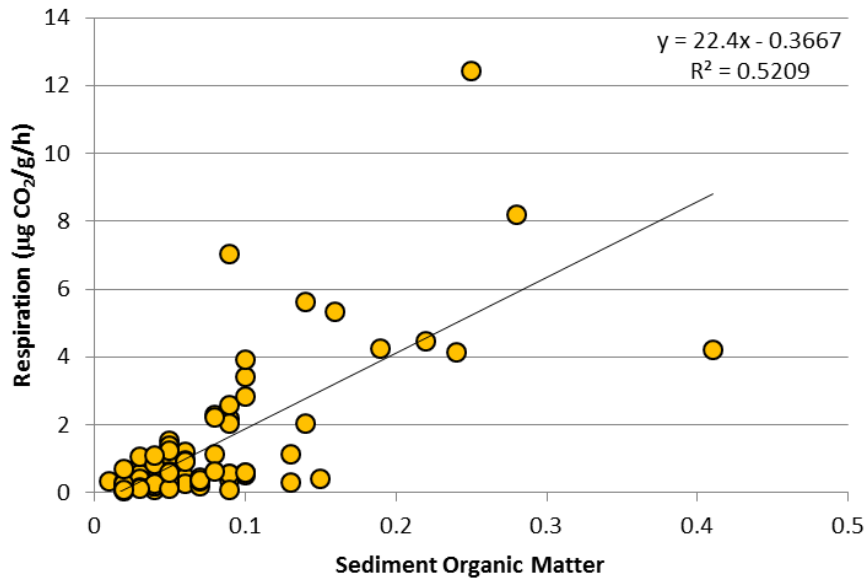


Laboratory methods for sediments

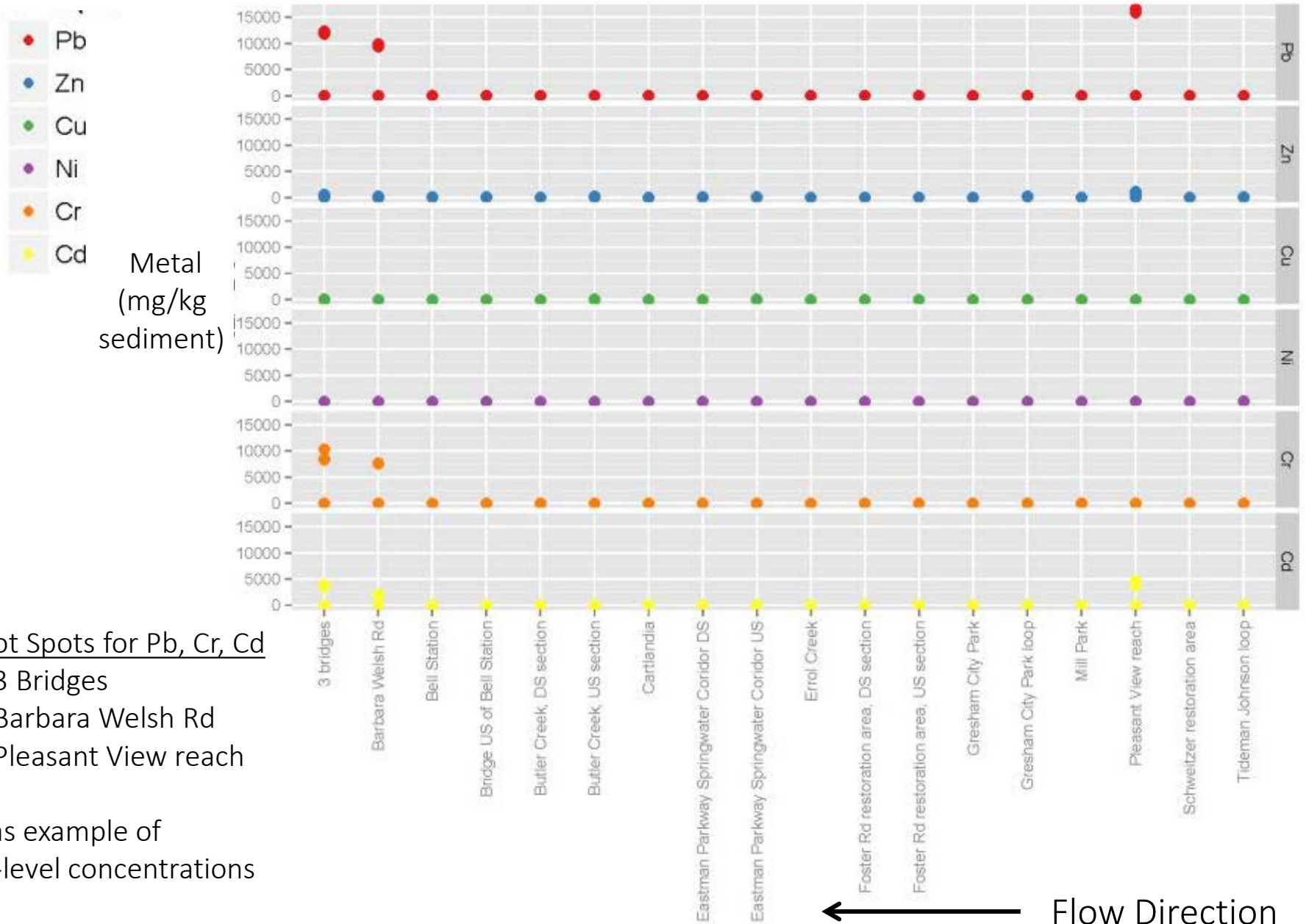
- Homogenize, 2-mm sieve
- Microbial activity assay (SIR: substrate-induced respiration)
- Denitrification potential (DEA: denitrifying enzyme assay)
 - Represents the potential of the microbial community to convert nitrate (an aquatic pollutant) to gaseous nitrogen (benign)
- Organic matter content
- Analysis of 15 metals (ICP-MS; HWU)



Sediment microbial activity and denitrification potential are related to organic matter content



Metal concentrations in sediments



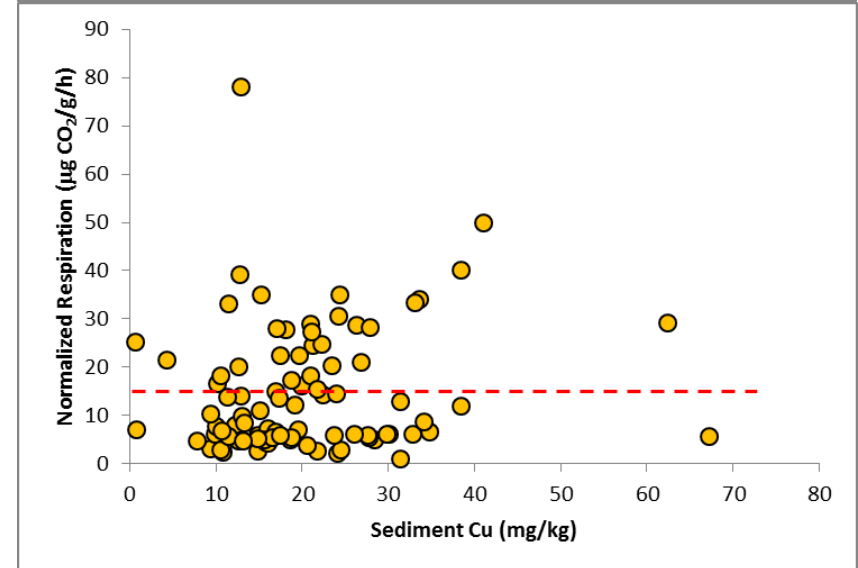
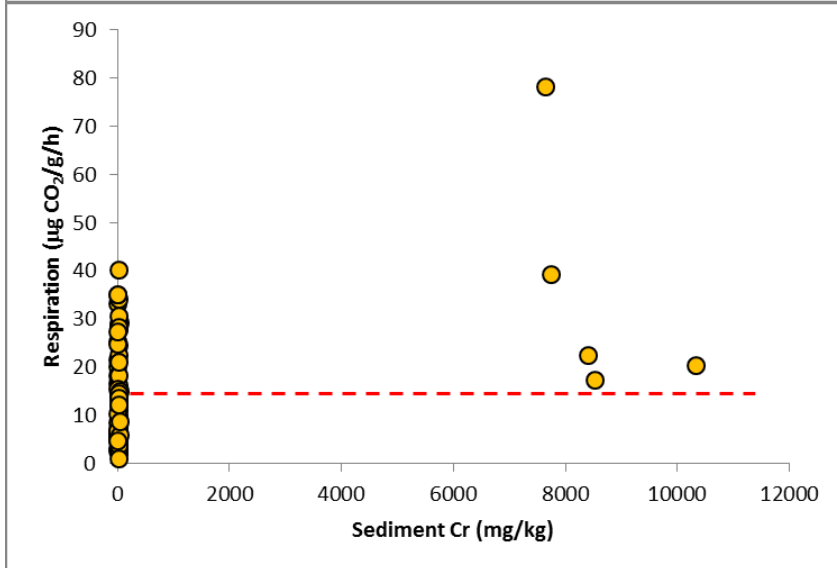
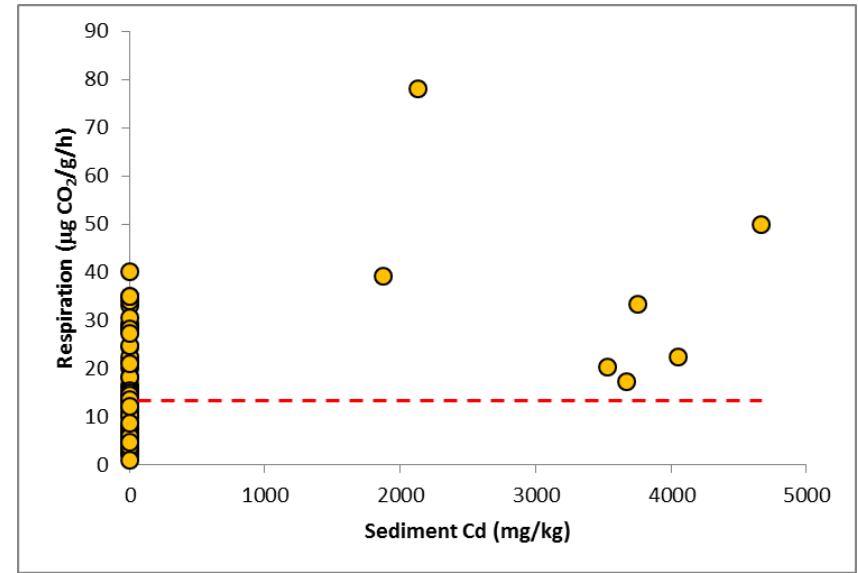
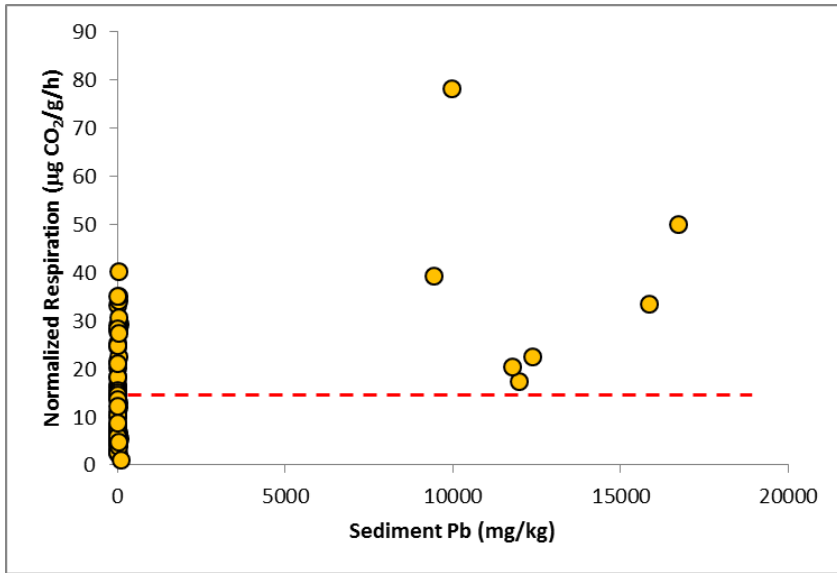
Hot Spots for Pb, Cr, Cd

- 3 Bridges
- Barbara Welsh Rd
- Pleasant View reach

Cu as example of low-level concentrations

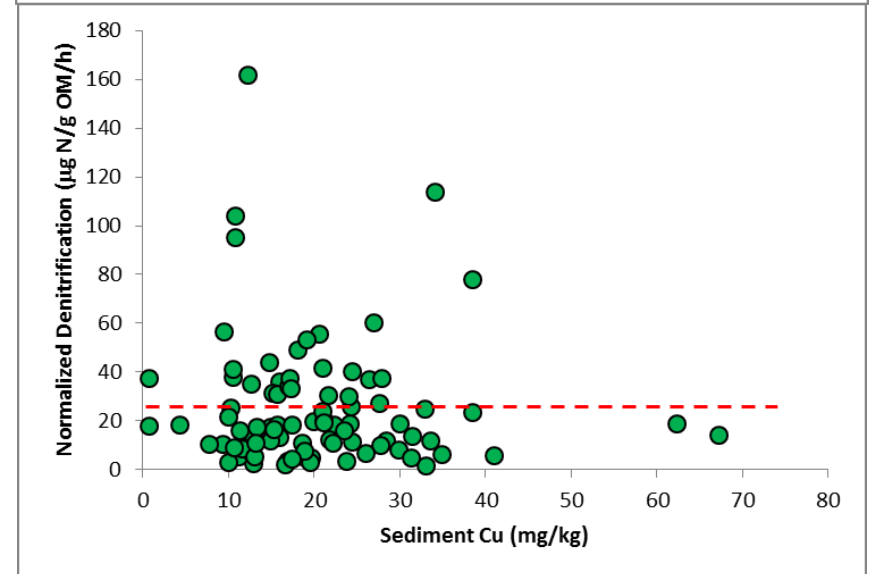
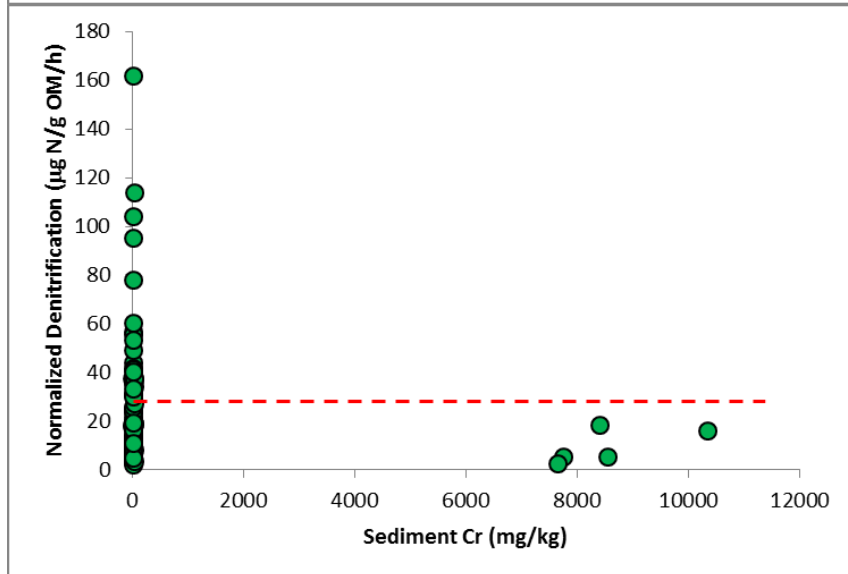
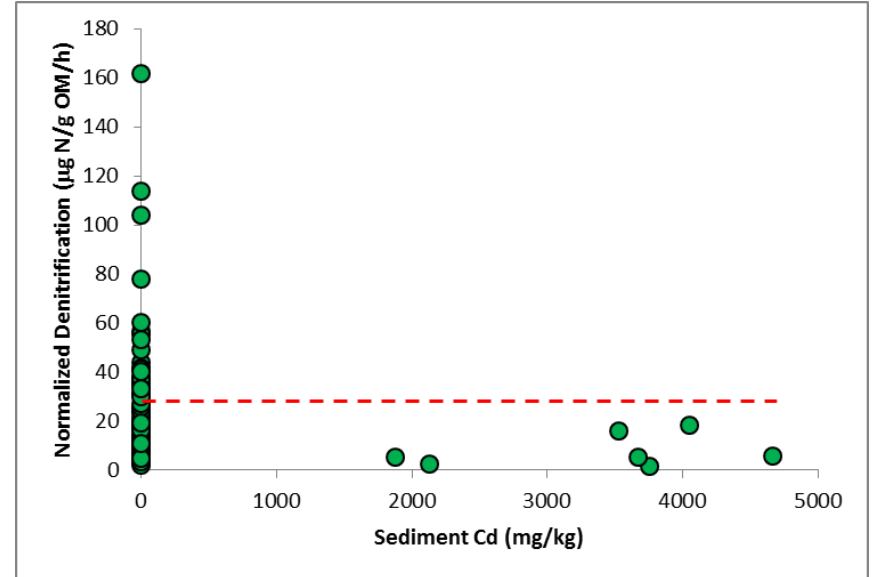
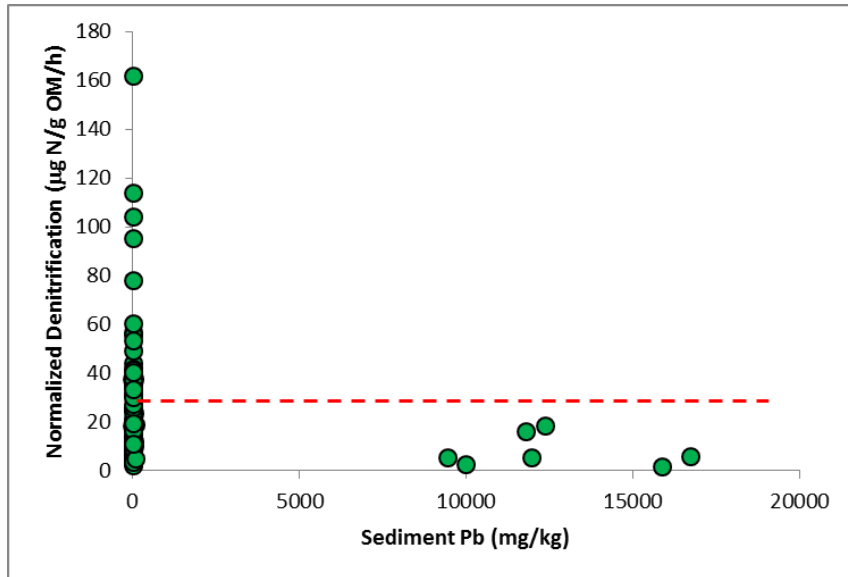
Effects of metals on sediment microbial activities

Suggests higher than average stress/activity with high concentrations of metals

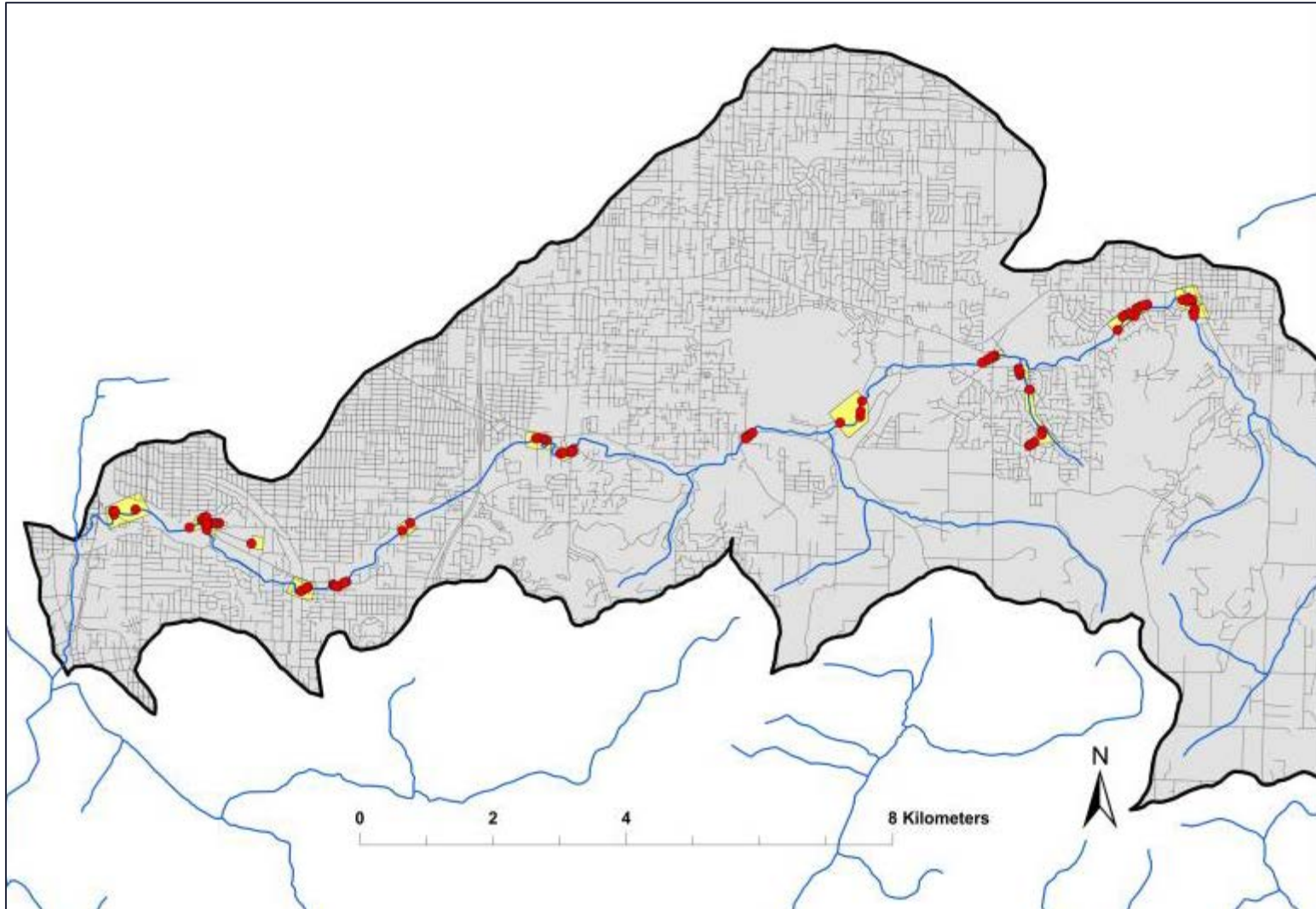


Effects of metals on sediment microbial activities

Suggests lower than average denitrification potential with high concentrations of metals



Further work: spatially explicit analyses



Acknowledgments

Field and lab assistance:

Students in my lab:

Jules, Matt, Brett, Ben, Erin, Jess,
Maks, Aarisa, Manar

Funding:

EPSCR-Blue Green Cities

Institute for Sustainable Solutions at PSU

ULTRA-Ex



Portland State
UNIVERSITY