

The ecology (*and evolutionary biology*) of
Urban Contaminants



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Minneapolis-St. Paul Metropolitan Area (MSP) Long Term Ecological Research Program

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MSP LTER





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The ecology (and evolutionary biology) of **urban contaminants**





Lead



Zinc



Cadmium



Arsenic



Nickel



Copper



Lead

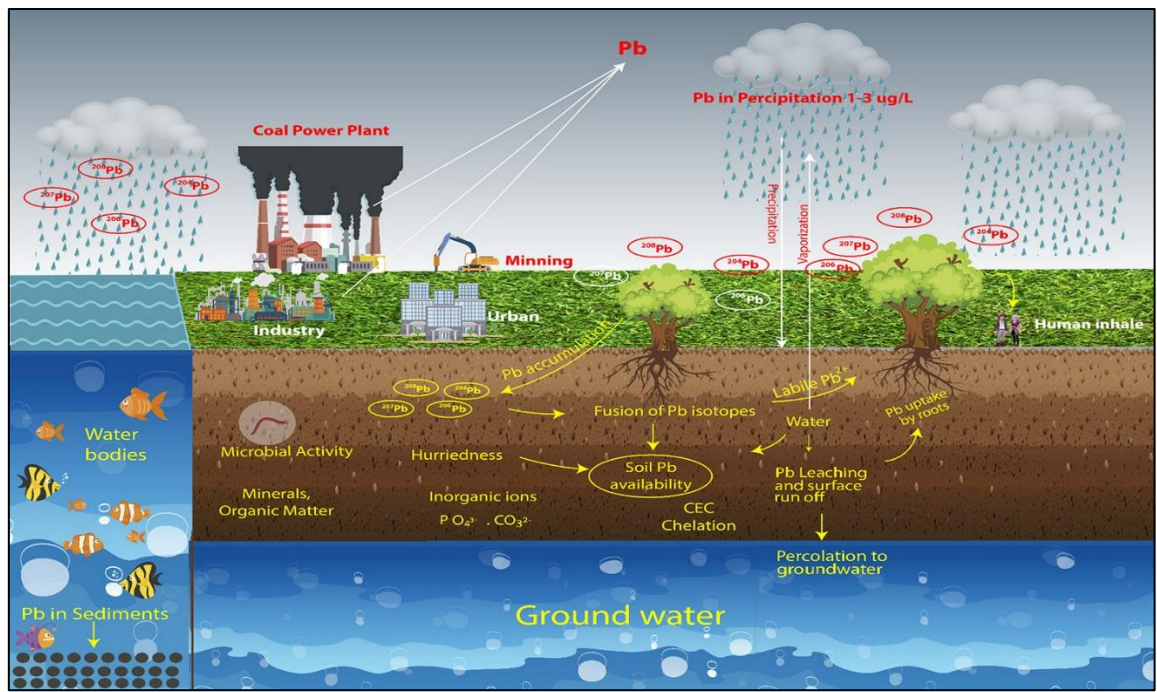
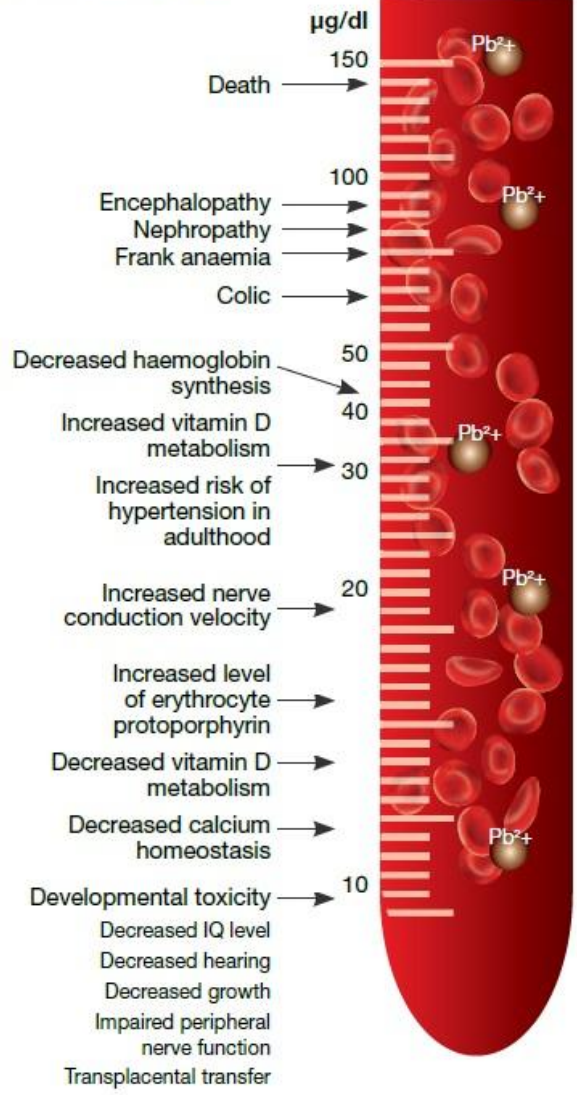


Figure 1: Paediatric effects of lead at various blood lead levels



The results of the remedial investigation demonstrate that low levels of contamination, primarily chromium (<35 ppm), copper (<40 ppm), and trichloroethene (<100 ug/L) are present in groundwater beneath the site. These were observed at significant levels in only one on-site well and one off-site well, however, the off-site well is not within the groundwater flow path of the site. The contaminants do not appear to be moving off-site or downward within the aquifer due probably to chemical-physical interactions with the silty-clay soil. Soil borings analyses demonstrate that some of the soil beneath the site is contaminated with metals (primarily chromium, copper, and nickel) and that most of the contaminated soil is probably the result of spillage and/or dumpage of liquids in the basement and pole barn area.

The evaluation of potential remedial action alternatives resulted in examination of five options: (1) no action, (2) monitoring groundwater, (3) pump and treat groundwater, (4) cap the site, and (5) excavate contaminated soils. While site conditions appear to justify little or no additional actions given the facts that (1) contamination appears not to be moving from the site, (2) little or no potential for human or environmental exposure exists at the site and (3) little or no impact would result if groundwater left the site (given land use in downgradient direction). The recommended alternative involves a

Shared interests...

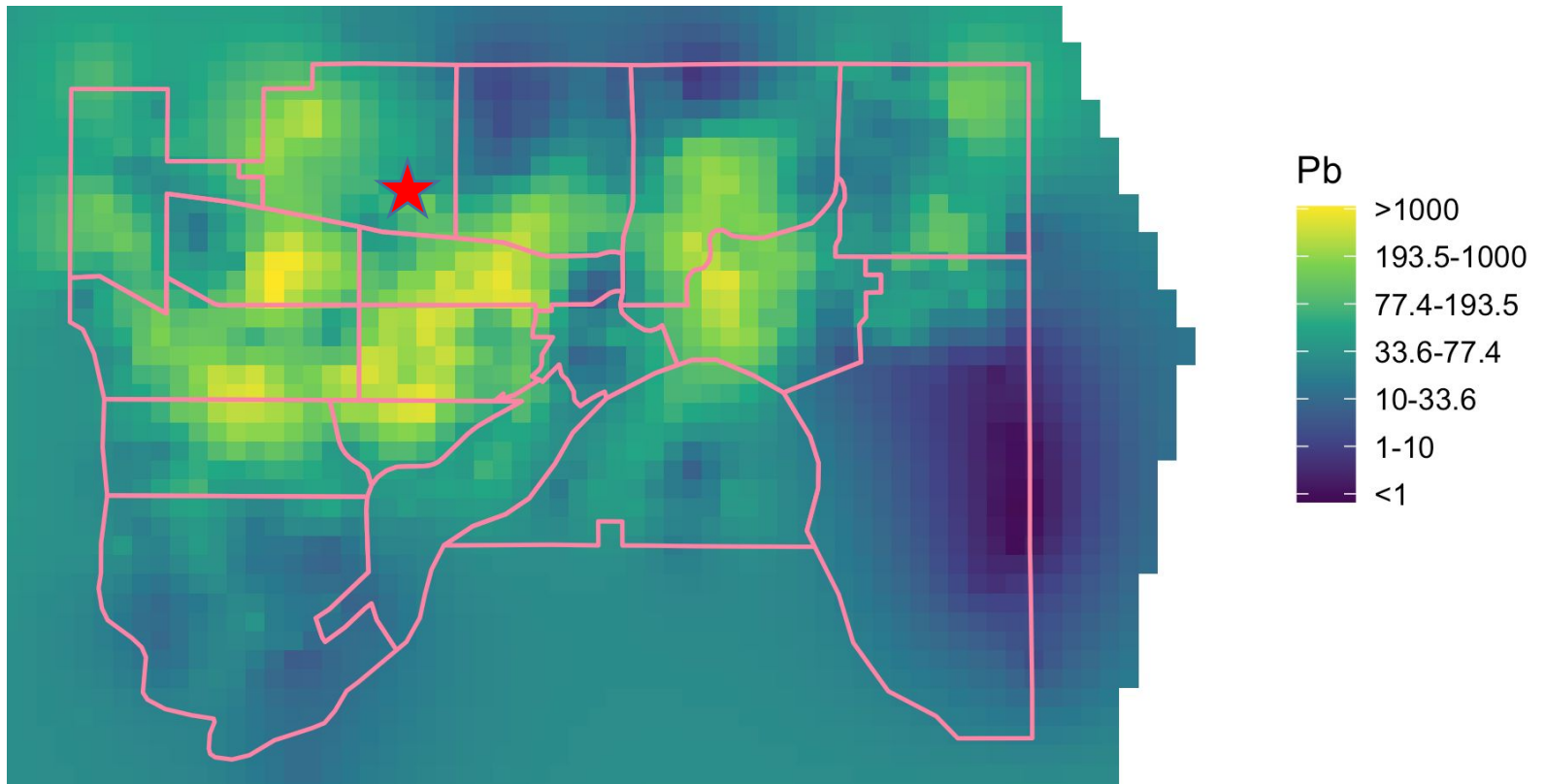
What can we offer?

A Phase II investigation was completed at the Site in March 2021. Twelve borings were completed at the Site for the collection of soil and groundwater samples. Twenty-eight shallow soil samples were collected and analyzed for the primary contaminants of concern (COCs); the eight Resource Conservation and Recovery Act (RCRA) metals, hexavalent chromium, cyanide, and volatile organic compounds (VOCs). Shallow surface soils were also sampled for gasoline range organics (GRO) and diesel range organics (DRO) to confirm whether surface soils within the root zone are an acceptable growing medium for crops. Hexavalent chromium and trichloroethene (TCE) were each detected in two soil samples at a concentration greater than their respective soil leaching values (SLVs). Arsenic and mercury were each detected in one soil sample at a concentration slightly greater than their respective residential soil reference values (SRVs).

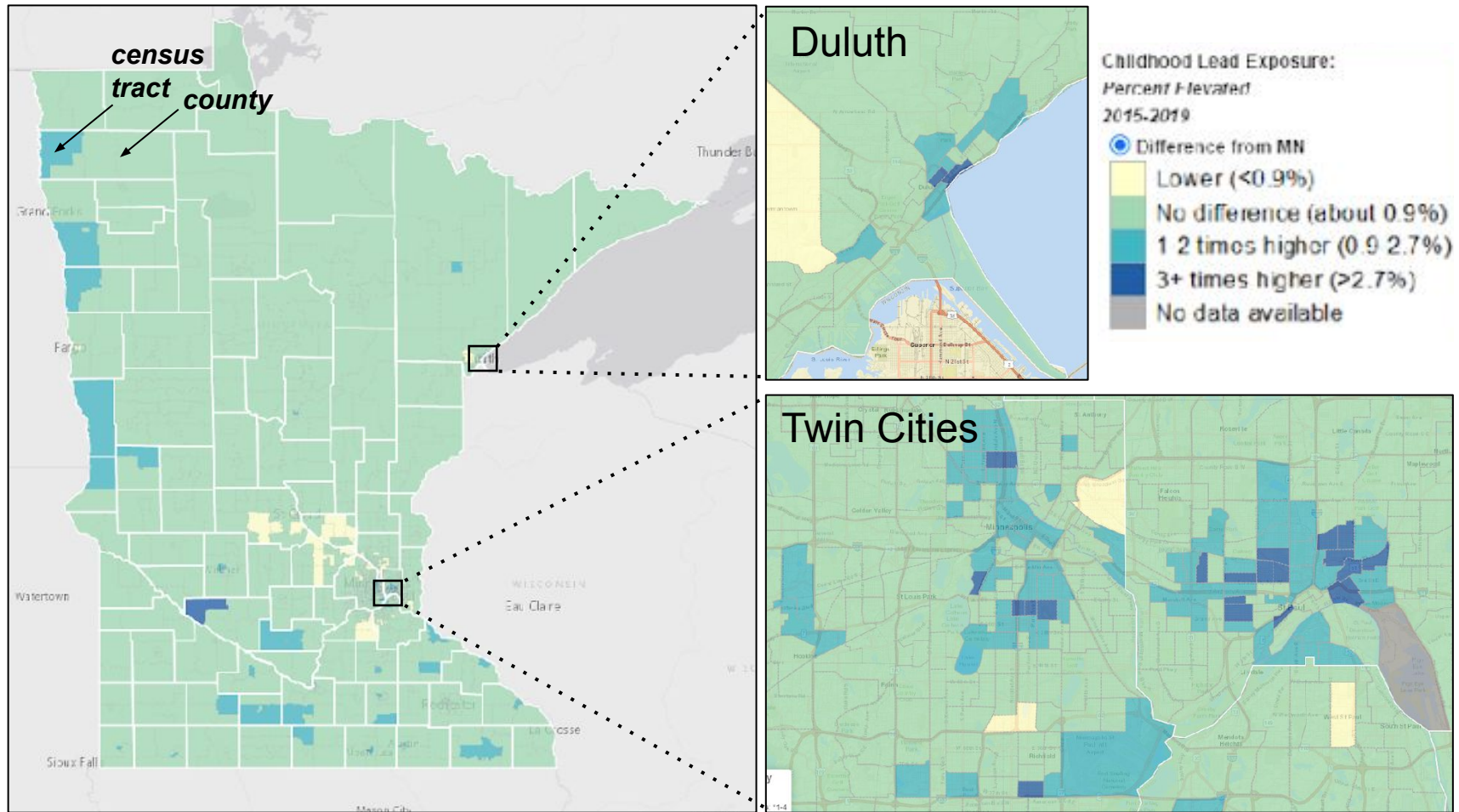
1. Mapping of soil and metal chemistry



Nic Jelinski

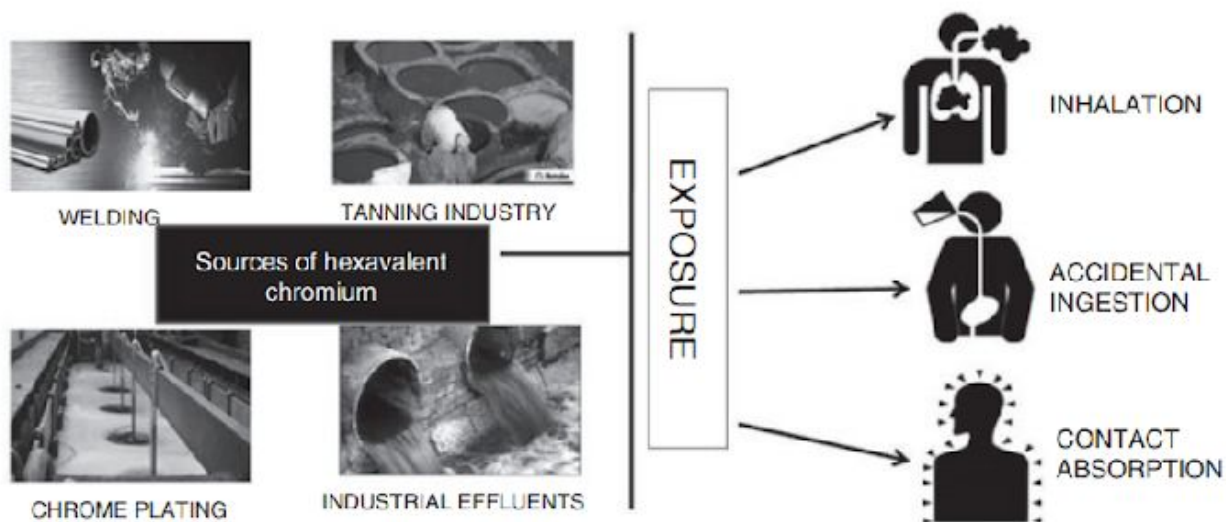
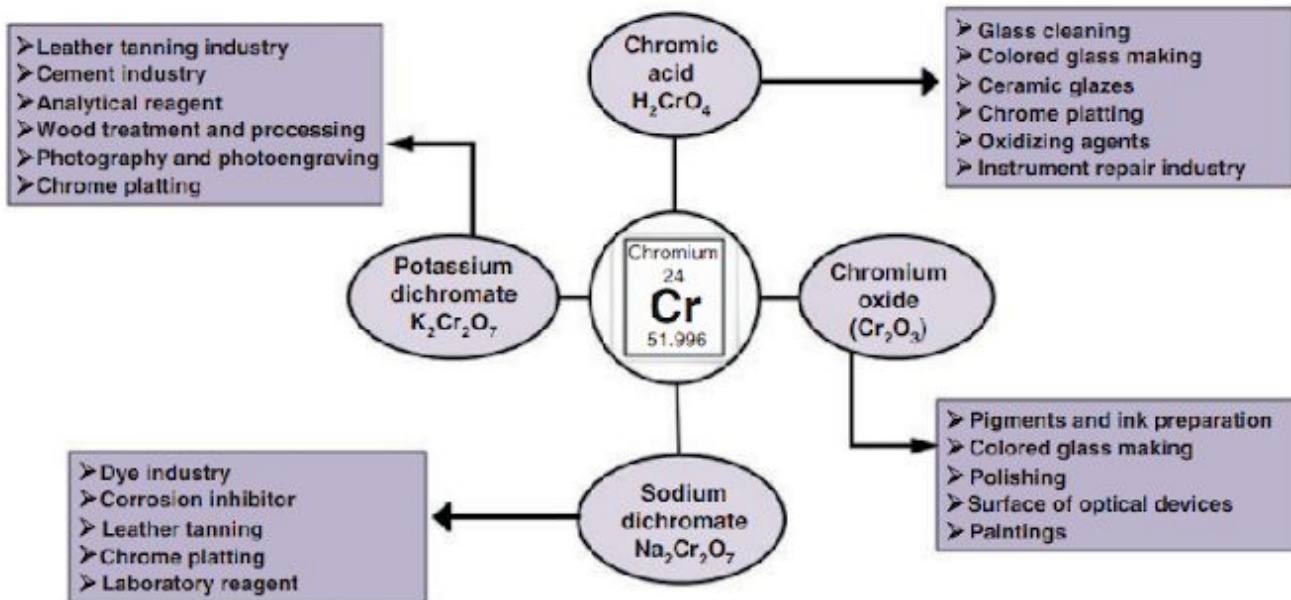


Correspondence with elevated childhood blood lead levels

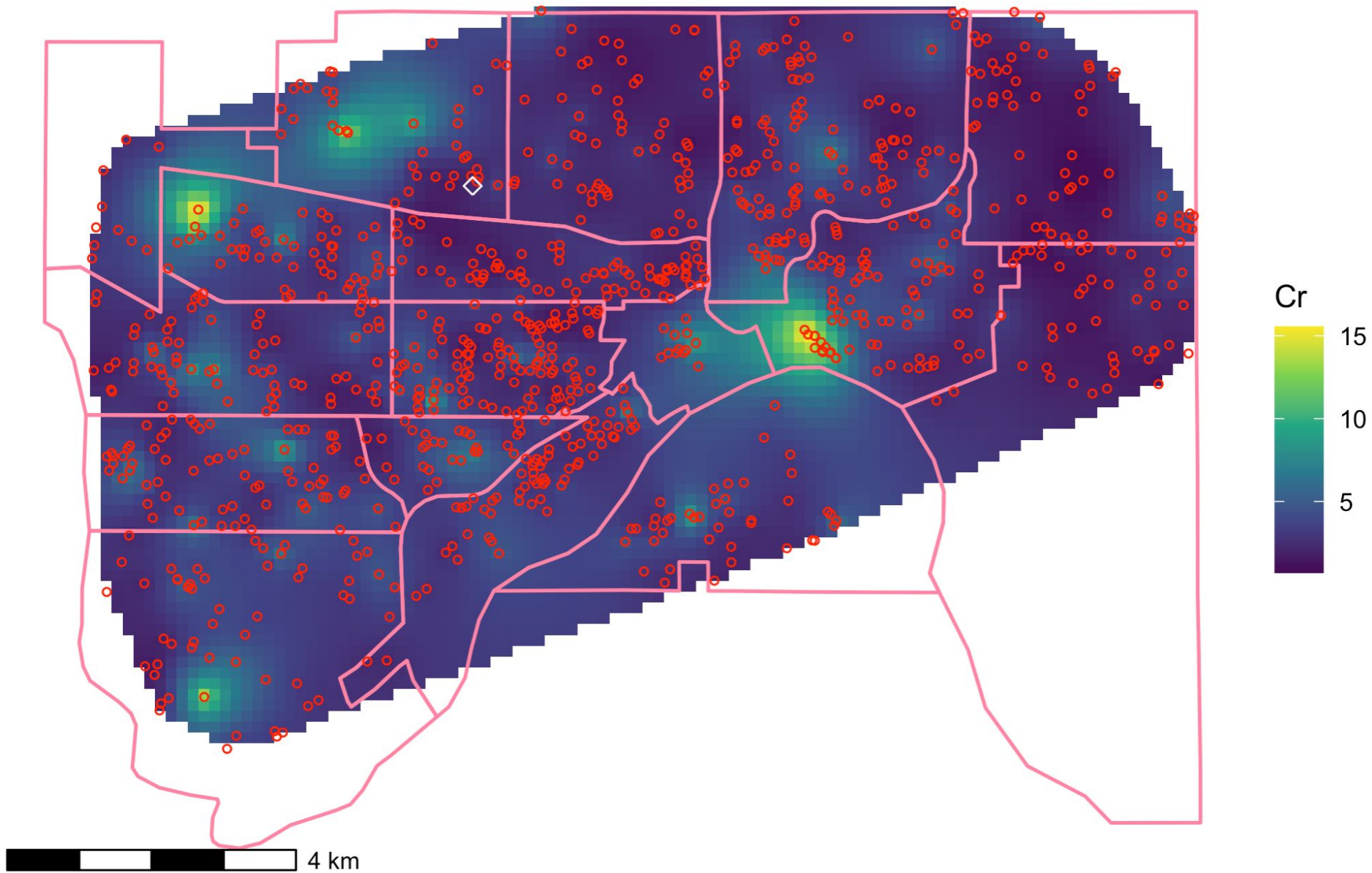


MN Dept. of Health: <https://mndatamaps.web.health.state.mn.us/interactive/leadtract.html>

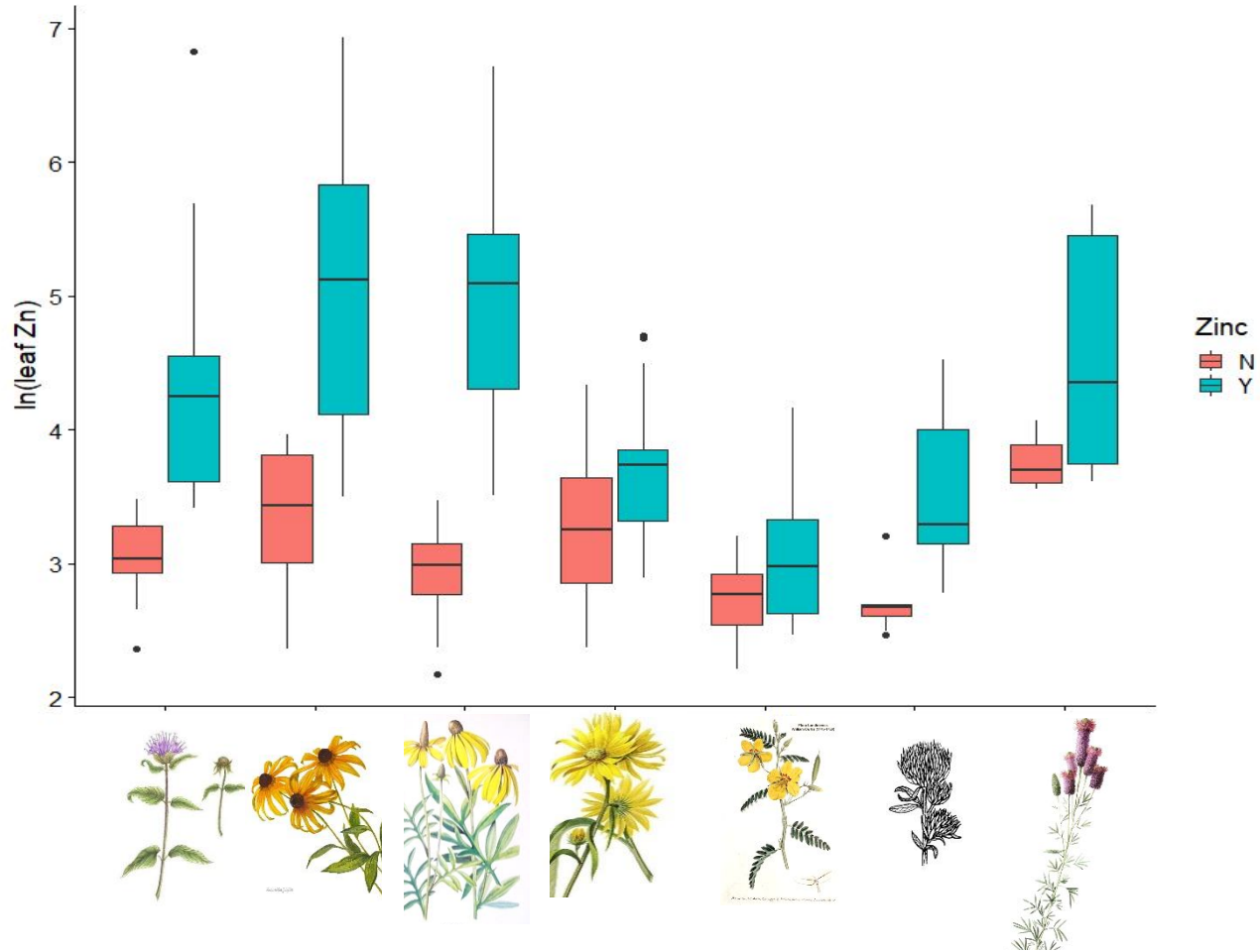
Most common forms of chromium compounds and their uses



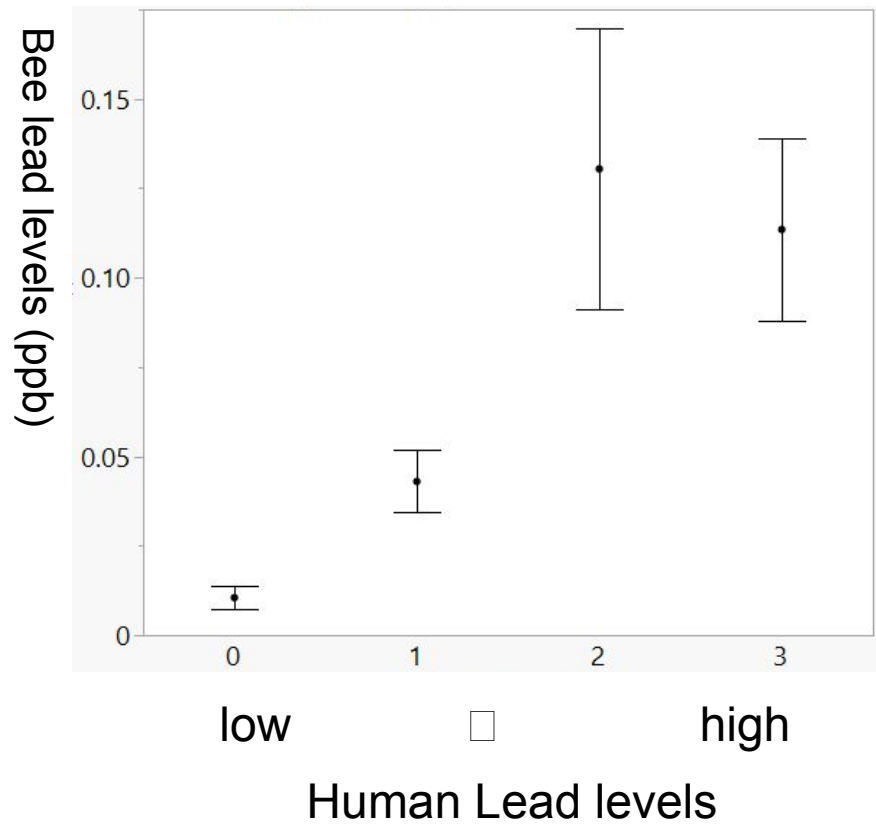
Context for Chromium: Jameson-Front is regionally high
--we can monitor over time... and specific chemistry



2. Movement into plants and insects at the site



2. Movement into plants and insects



Lauren Agnew

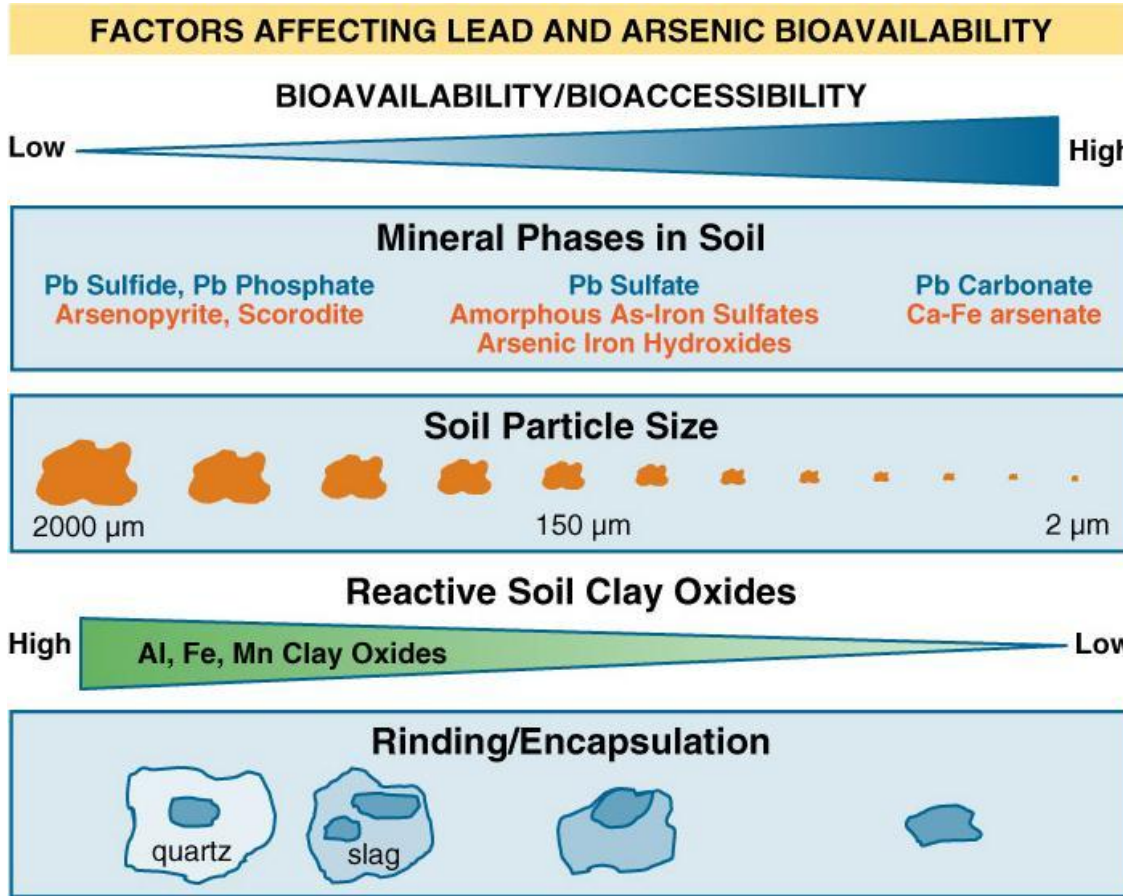


3. Specific interventions and metal mitigation

Soil amendments... including leaf litter



Cara Santelli



From: <https://bcs-1.itrcweb.org/3-technical-background/>

3. Specific interventions and metal mitigation

Worm activity and chemistry

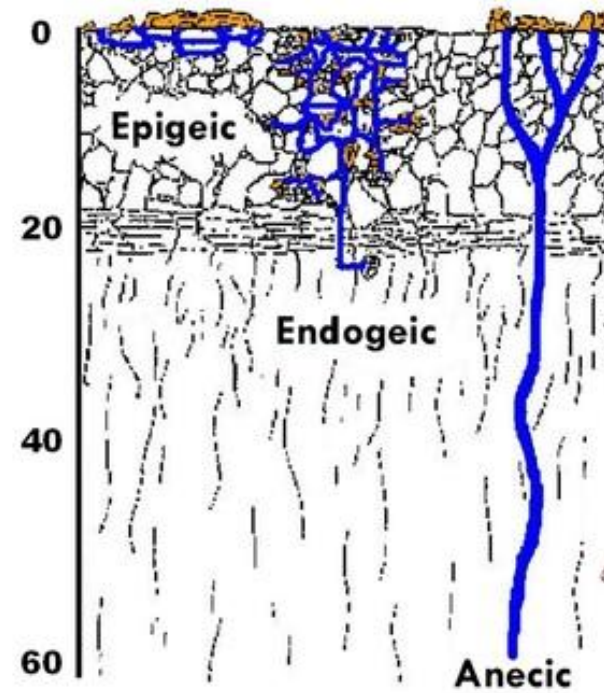


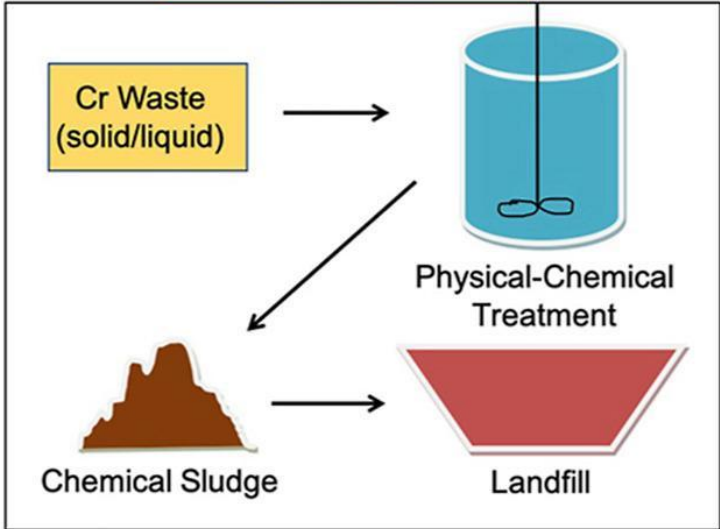
Diagram courtesy of the Science Learning Hub. Figure adapted from Fraser and Boi



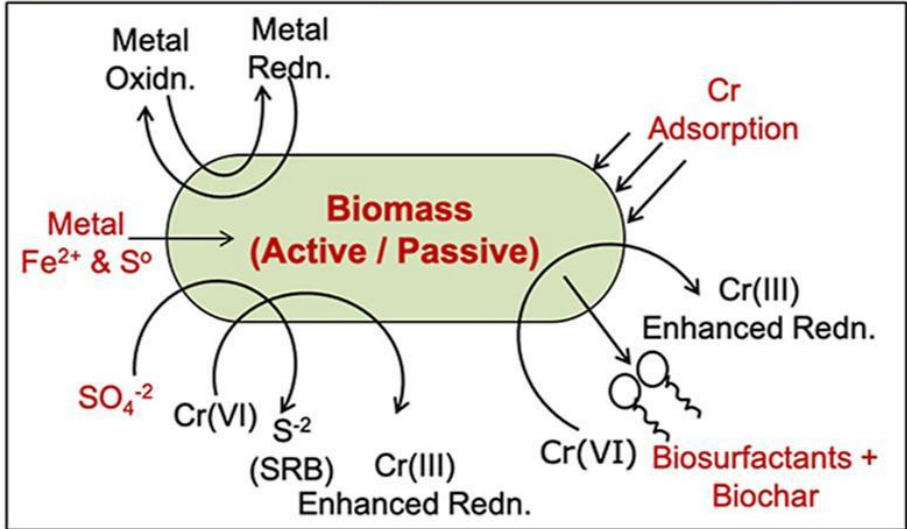
MUTAGENIC & CARCINOGENIC CHROMIUM ENTERS ENVIRONMENT

Physical - Chemical Treatment

Bio-based Strategies



Expensive, Energy Intensive, Loss of metal resource, Unsustainable



Inexpensive, Efficient, Recovery of metal resource, Sustainable

Questions

- What research questions are of interest to this group?
- What background information is relevant for next week?