GREAT SALT LAKE DUST CONTAINS BIOAVAILABLE METALS THAT MAY IMPACT HUMAN HEALTH THROUGH DIRECT INGESTION OR ACCUMULATION IN FOOD CROPS

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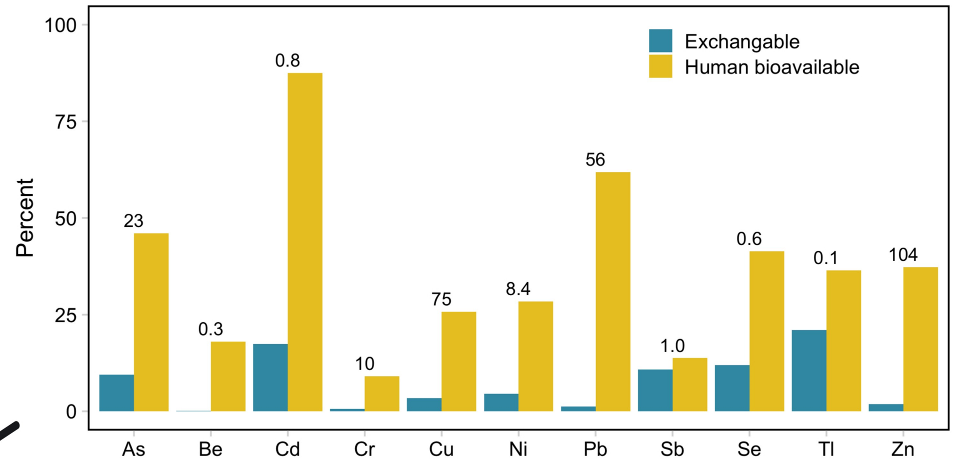
Human water use and climate change have drained Great Salt Lake (GSL) to its lowest water levels in recorded history, exposing nearly 1,000 square miles of dry lakebed sediments to potential erosion and entrainment in the atmosphere. High concentrations of fine dust pose an acute health hazard regardless of chemical composition. However, dust produced from GSL sediments contains metals of concern such as As and Pb, and the potentially additive or synergistic effects of exposure to dust that contains deleterious metals are not well understood.

In this study, we explored potential direct and indirect health concerns related to GSL dust exposure by assessing the relative solubility and bioavailability of dust-bound metals. We targeted exchangeable (i.e., soluble) metals using ammonium acetate and human bioavailable metals using a simulated gastric acid mixture. We assumed total metals concentrations from dust treated with aqua regia.

We also examined potential effects of metals-laden dust on crops cultivated downwind from the dry lakebed. Specifically, we tested the hypothesis that cabbage leaves can accumulate metals from GSL dust. We cultivated cabbage at Utah State's Research Greenhouse and exposed the plants to GSL dust via 1) foliar application (i.e., dust added directly to leaf surfaces), 2) dust mixed into the soil, and 3) control (i.e, no dust). We measured metals in the dust and cabbage leaves at the University of Utah's ICP-MS Metals and Strontium Isotope Facility and assessed the effects of different dust treatments on cabbage metals contents using generalized linear mixed models.

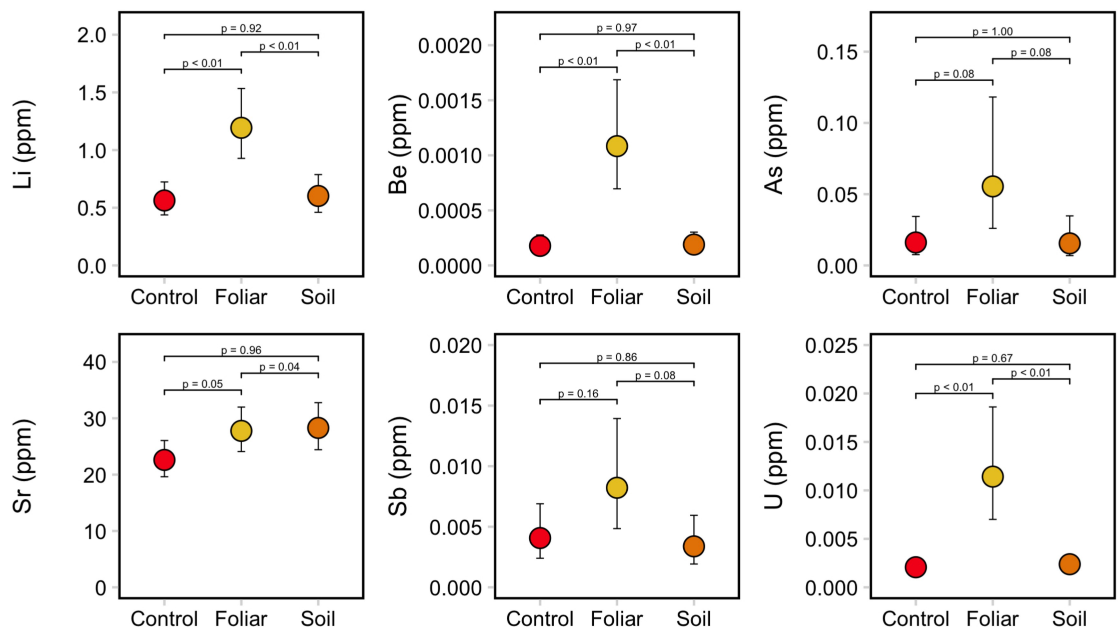


This figure shows metals from the EPA's list of Priority Pollutants in the exchangable and human bioavailable fractions of GSL dust as percent of total metals concentrations, which are labeled above each bar (ppm).

Exchangeable metals are more likely to sorb to soil particles or dissolve in natural waters. Human bioavailable metals are more likely to induce toxic effects when GSL dust is inhaled or ingested.

Dust composition data from this study can be paired with other data (e.g., from continuous ambient air quality monitors) to quantify rates of exposure to dust-dervied metals, a critical component of future GSL dust health risk assessments.

Metals-laden dust from GSL adds to the existing pollution burden faced by Wasatch Front communities by degrading the quality of the air we breathe. It can also impact the food we grow, the livestock we feed, and the water we drink and use for irrigation.



This figure shows that exposure to GSL dust, particularly foliar exposure, can transfer metals to cabbage leaves.

Future work is needed to evaluate effects of GSL dust on other plant types such as root vegetables and alfalfa, as well as to contextualize metals contributions from GSL dust relative to other sources of metals pollution from soils and from the atmosphere.

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