

Utilizing Vegetation Surveys at Legacy Mine Sites to Uncover Metal Accumulation and Tolerance Strategies in Native Plants

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Utilizing Vegetation Surveys at Legacy Mine Sites to Uncover Metal Accumulation and Tolerance Strategies in Native Plants

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BACKGROUND & GOALS

Arizona, a top U.S. copper producer, faces public health and environmental risks from mining.

PHYTOREMEDIATION is a potential solution, but limited knowledge of local metal-accumulating and meta-tolerating plants hinders its application.

Our study addresses this by extensively characterizing plants at legacy mine sites using optimized portable X-ray fluorescence (pXRF) for efficient and large-scale analysis.

STUDY AREA & SAMPLING

A survey was conducted at a U.S. Southwest Cu and Mo sulfide-bearing tailings facility. At this site, plant and soil samples were collected from four plots in three replicates. Our study identified 40 plant species and analyzed 320 samples using pXRF, enabling detailed metal characterization.

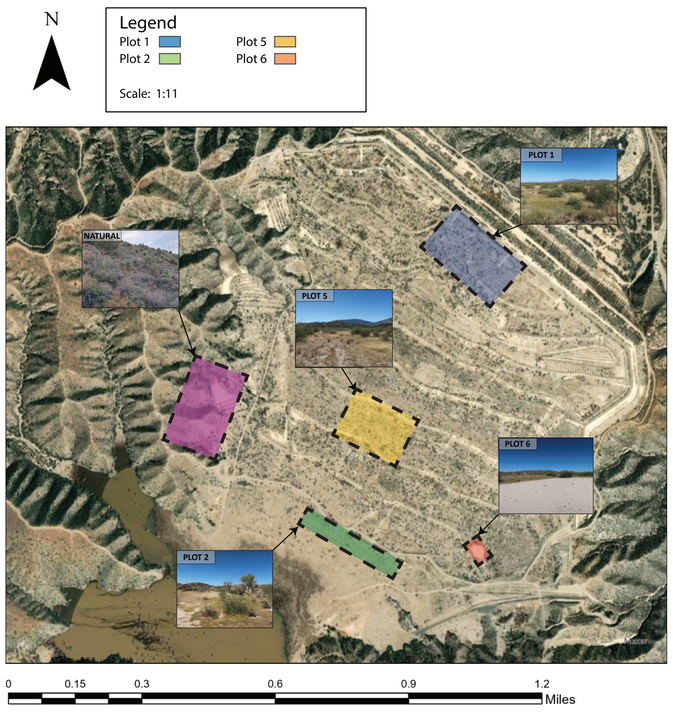


Fig. 1. Vegetation survey plots at the study site. Four plots were selected at the tailings pond and one natural plot from adjacent location

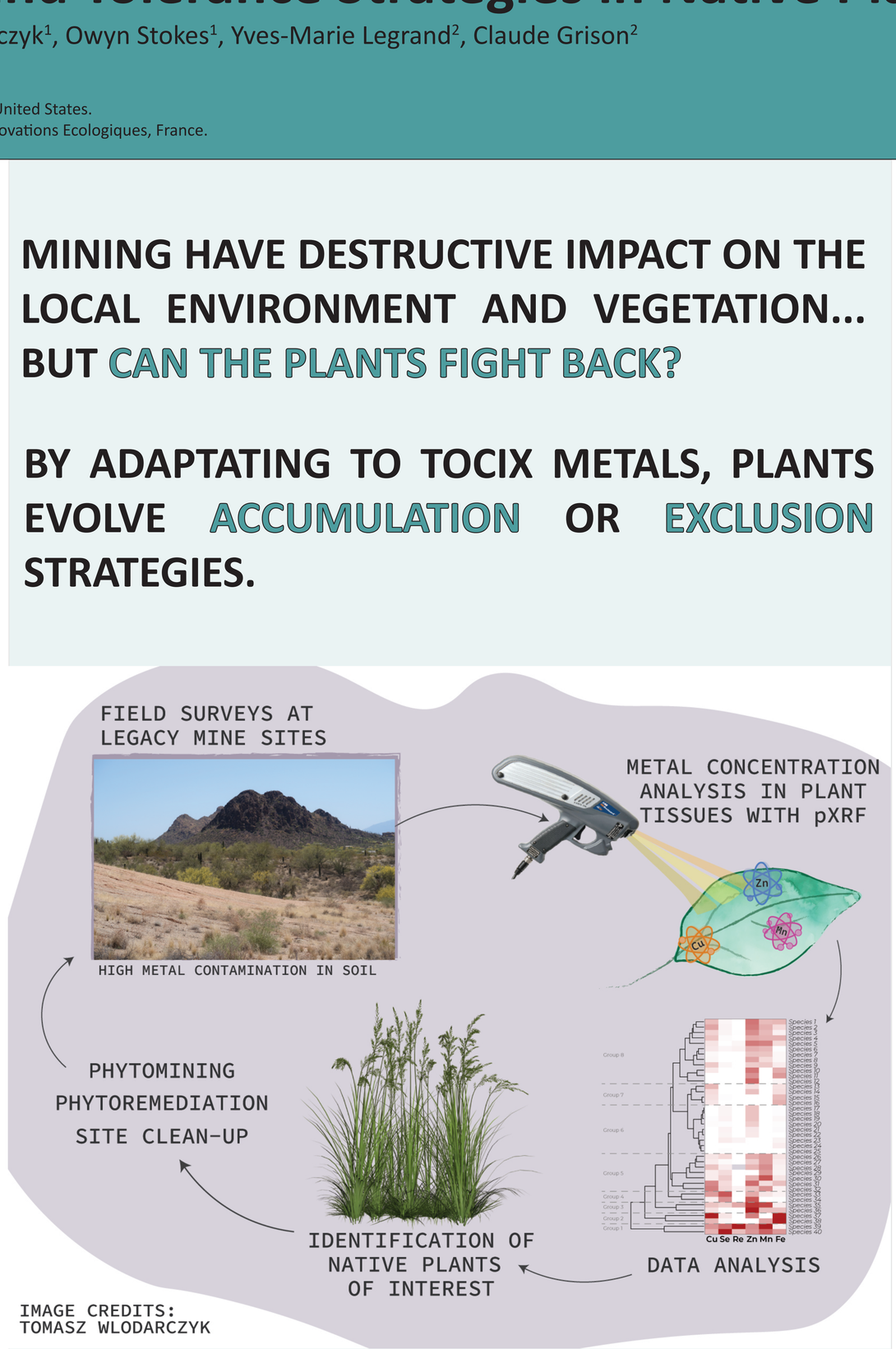
PROMISING EXCLUDERS AND ACCUMULATORS

The most promising metal excluders found were grasses, that maintained optimal levels in their aerial parts. Additionally, three forbs and one tree species accumulated high concentrations of specific metals without showing any toxicity symptoms.



MINING HAVE DESTRUCTIVE IMPACT ON THE LOCAL ENVIRONMENT AND VEGETATION... BUT CAN THE PLANTS FIGHT BACK?

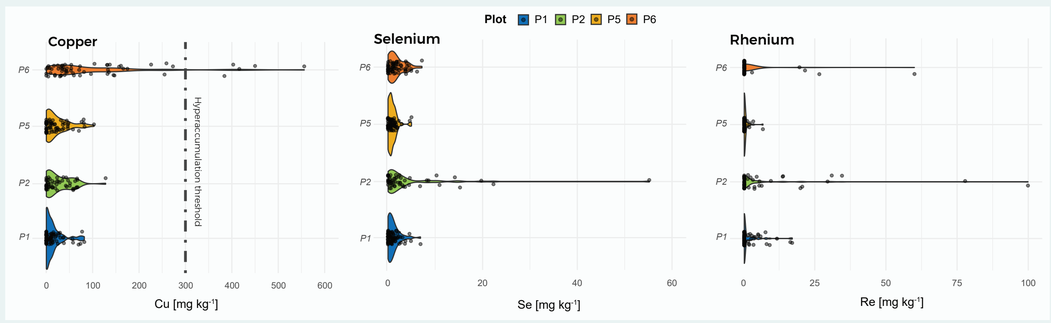
BY ADAPTATING TO TOCIX METALS, PLANTS EVOLVE ACCUMULATION OR EXCLUSION STRATEGIES.

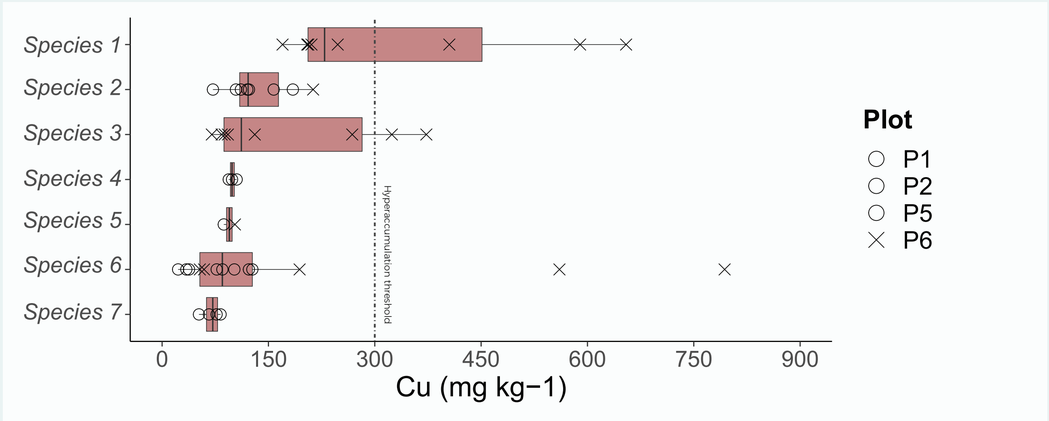


WE APPLY NOVEL TECHNIQUES TO FIND THE MOST PROMISING PLANT SPECIES FOR RESTORATION OF DISTRUBED LANDS.

METAL ANALYSIS IN PLANTS

Most plants in our study were metal excluders, but some showed accumulation of Cu, Se, and Re, with Cu found at the highest concentrations among all elements. High Cu uptake was unique to Plot 6, indicating that specific soil parameters at that particular location may support Cu hyperaccumulation.





SUBSTRATE ANALYSIS

Soil was collected from the surface (S) layer (5-10 cm depth) and from the underlying tailings (T) layer (>20 cm depth) across study plots (P1, P2, P5, P6) and from the natural, adjacent site. Nine replicates were collected at each layer for each plot.

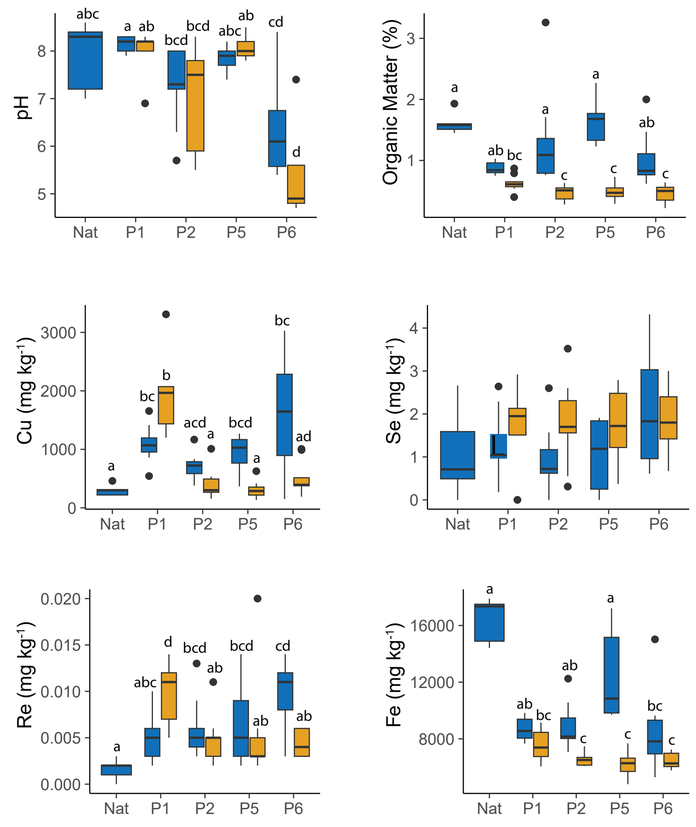


Fig. 2. Soil parameters and concentrations of elements from surface (3 - 30 cm) and tailings (> 30 cm) layers.

NEXT STEPS

The follow-up studies will evaluate the uptake of promising accumulators under controlled conditions. A Micro-XRF instrument will be employed to elucidate paterns of elemental allocation in leaf and investigate the potential influence of dust deposition on elevated Cu readings obtained from pXRF. Confirmed hyperaccumulators will be cultivated for biomass production and provided to ChimEco laboratory for the development of novel Eco-catalysts.

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Center for Environmentally Sustainable Mining

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PLANT-SOIL-ENVIRONMENT LABORATORY