Mapping the metal uptake in plants from Jasper Ridge Biological Preserve
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Serpentine soil is derived from rocks that originated in the mantle and contain high concentrations of Fe and Mg. The soil contains high concentrations of heavy metals such as Ni and Cr, low concentrations of essential nutrients such as N, P, and K, and a low ratio of Ca to Mg. Due to its proximity to the San Andreas Fault, Jasper Ridge Biological Preserve, located behind SLAC National Accelerator Laboratory, contains regions of serpentine soil. Although serpentine soil suppresses plant growth, certain plants at Jasper Ridge have adapted to growing on it, such as rye, squirreltail, and purple needlegrass. The elemental uptake and distribution of these plants, along with non-adapted common wild oat, was compared to plants grown hydroponically and on potting soil using micro-focused X-ray fluorescence spectroscopy at the Stanford Synchrotron Radiation Lightsource. The hydroponically grown plants contained varying concentrations of Ca and Mg. X-ray fluorescence spectroscopy involves ionizing a material with X-rays, releasing photons with characteristic energies. The photon energies allows one to determine which elements are present. Rye grown on potting soil was enriched in Ni, Fe, Mn, and Cr compared to purple needlegrass grown on serpentine soil. Serpentine vegetation equally suppressed the uptake of Mn, Ni, and Fe in the roots and shoots. Varying the concentration of Ca and Mg in plants affected the uptake of other elements such as K, S, and P. The results provide further knowledge of the relationship between soil composition and elemental uptake in vegetation and can be applied to similar metal-contaminated soil systems. In the future, different plants at Jasper Ridge will be grown hydroponically to control the uptake of nutrients and metals. The results can be used to hypothesize biological controls used by the plants, and identify which genes confer or prohibit serpentine tolerance.