

Reducing trophic transfer of uranium from plants to sheep to Navajo people: can root fungi help sequester U in plant roots?

**KATHERINE DUNLAP, LAURA WASYLENKI AND
PIYALI CHANDA**

Northern Arizona University

Presenting Author: kd825@nau.edu

Navajo people living a traditional lifestyle in the American Southwest experience elevated rates of certain cancers and kidney disease because they live in proximity to hundreds of abandoned uranium mines [1]. Consumption of mutton is one significant exposure pathway; sheep are of essential economic and spiritual importance to the Navajo Nation, but they graze on plant shoots growing in uranium-contaminated soil. All portions of sheep are consumed or utilized, and uranium concentrations are particularly high in bone, liver, and kidneys [2]. How might chronic uranium exposure through the food chain be reduced in an economically feasible and culturally considerate manner?

Two previous studies [3,4] observed that symbiotic root microbes (arbuscular mycorrhizal fungi, or AMF) increased the total amount of uranium taken up by sunflower plants from soil, but also strongly affected the translocation of uranium, sequestering most of it in the roots and very little in the shoots and leaves. In Chen et al.'s work, shoot U concentrations were reduced by almost half when AMF were applied [4]. This decrease in translocation from roots to shoots could reduce the amount of uranium consumed by sheep, thus reducing exposure risks for the Navajo people. But how does this phenomenon work? In factorial greenhouse experiments, we investigated how soil geochemistry and fungal communities influenced the uptake and isolation of uranium in sunflower roots, by using soil media of differing clay content, watering with different concentrations of uranium, and inoculating roots of some plants with AMF. Quantification of U in experimental plant tissue (determined by ICP-MS) sheds insight on how root fungi and soil geochemistry affect U uptake and translocation mechanisms. Our results may lead to the development and enhancement of non-destructive soil remediation strategies for reducing U exposure to the Navajo people.

[1] Brugge & Goble (2002) *Am J Public Health* 92, 1410-1419.

[2] Lister et al. (2021) *J Vet Med Animal Sci.* 4(1), 1055.

[3] Dupré de Boulois et al. (2008) *J Environ Radioact.* 99, 775-784.

[4] Chen et al. (2005) *Plant and Soil.* 275, 349-359.