☐ **Talk** ☒ **Poster**

Chemical Transport Effect on Bioavailable Phosphorus and Sulfur and Their Speciation in Livestock Wastewater-Impacted Texas High Plains Wetlands

Sharon P. Ulate Chacón[1], Emma Hart[1], India Reddell[2], Kathryn D. Szerlag[2], Ryan Tappero[3], Paul Northrup[4], Matthew G. Siebecker[1]

[1]*Department of Plant and Soil Science, Texas Tech University, Lubbock, TX, 79410*
[2]*Department of Soil and Crop Sciences, Texas A&M University, College Station, TX, 77843*
[3]*National Synchrotron Light Source II, Brookhaven National Laboratory, Upton, NY 11973*
[4]*Department of Geosciences, Stony Brook University, Stony Brook, NY 11794*

Author Email: sulate@ttu.edu

Playas are shallow, ephemeral wetlands that can play a critical role in water storage, aquifer recharge, and nutrient cycling in the Southern High Plains. The discharge of wastewater from agriculture and livestock into playas, a common practice in Texas, introduces high nutrient loads, such as phosphorus (P), raising concerns about environmental and groundwater quality. On the other hand, sulfur plays a key role in redox reactions which can influence phosphorus mobility through complexation and microbial interactions. The main focus of this study investigates the vertical transport and chemical speciation of P and S in a wetland with animal feeding operation (AFO) wastewater inputs in New Deal, Texas. Soil samples were collected at three depths and analyzed for Mehlich-3 extractable P and S. A strong positive correlation was observed between extractable P and S concentrations ($R^2 = 0.76$) and P and SOM ($R^2 = 0.89$), suggesting that wastewater inputs may be enriching both elements simultaneously and increasing the OM content slong the soil profile. Synchrotron-based microanalyses further revealed that at the micron scale, P and S were mainly spatially independent from each other in the surface soils; however, several regions within the μXRF maps indicated co-location of the two elements. Therefore, the specific speciation of P and S is expected to be heterogeneous, and analysis of the μXANES spectra is currently underway. These findings underscore the need to evaluate both nutrient concentrations and speciation to fully understand their mobility, transformation, and environmental risk in playa wetland systems impacted by animal manure wastewater.

References

[1] Acree, A., D.C. Weindorf, S. Chakraborty, and M. Godoy. Comparative geochemistry of urban and rural playas in the Southern High Plains. *Geoderma* **337**: 1028–1038 (2019).
[2] Szerlag, K.; Elavarthi, M.; Siebecker, M.; Gu, C.; McCrone, C.; Sparks, D. Systematic Study of Legacy Phosphorus (P) Desorption Mechanisms in High-P Agricultural Soils. *Minerals* **12**, 458 (2022).