Closing the Soil Health Gap for High Plains Agroecosystems

1&2. Faculty Mentor: Dr. Jim Ippolito, Soil and Crop Sciences, College of Agriculture; jim.ippolito@colostate.edu (work: 970-491-8028; cell: 970-402-8033). Dr. Megan Machmuller, Soil and Crop Sciences, College of Agriculture; megan.machmuller@colostate.edu (work: 970-491-6517). Dr. Emad Aboukila, visiting scholar from Egypt (June 1 through November 30, 2021); Field-based Mentor: Dr. Wilma Trujillo, CSU Extension – Logan/Morgan Co.; Wilma.trujillo@colostate.edu (work: 970-522-3200)

3. Field work will occur in Adams, Logan, Morgan, and Phillips counties

4. The Internship goals are to work closely with several soil health and agronomic experts in the region to quantify "soil health gap" differences between cropping systems and "benchmark" or "target" soils from relatively undisturbed ecosystems. This project is in its infancy, so the intern will learn how to start a state and regional-wide project, truly from the ground up. The ultimate outcome of this project is to: 1) suggest potential best management alterations to help producers create more resilient, sustainable agroecosystems; 2) link soil health metrics to agroecosystem productivity; 3) identify a minimum dataset required for quantifying soil health across agroecosystems within the region; 4) create interactive data products for interested soil health end-users in the High Plains; and 5) link outcomes to the Colorado Collaborative for Healthy Soils workgroup (both PI Ippolito and Machmuller are members) for additional producer use and guidance for developing future, regionally coordinated soil health metrics (e.g., within the newly formed [2020] Western US Soil Health Workgroup; PI Ippolito is a co-lead on this project). The project scope is to 1) identify benchmark soils for a total dataset of approximately 40-60 soils in (un)disturbed high plains soils, and 2) develop a minimum dataset for evaluation of sustainability of dominant agroecosystem practices in each study area. The project objective involves quantifying and linking baseline soil health metrics from undisturbed, local/regional ecosystems and the dominant agroecosystem practices in the High Plains region. We hypothesize that undisturbed ecosystems (e.g., short- or mixed-grass prairies) have soil physical, chemical, and biological attributes that are different from managed agroecosystems, and represent the potential soil health gap.

5. This applied research project has been under development over the past four years, based on the fact that in most areas globally, soil health experts are comparing best management practices within agroecosystems to one another in order to quantify soil health alterations. Our approach utilizes undisturbed ecosystems as another proxy for closing the "soil health gap" in terms of what might possibly be attainable in managed agroecosystems.

6. The intern will be introduced to the Colorado Collaborative for Health Soils, a 150+ member group focused solely on creating a soil health program within the state of Colorado. The intern will also be introduced to members of Progressive Farms (Byers, CO), Pfatzgraff Farms (Haxtun, CO), and other entities.

7. Learning outcomes will consist of: 1) how to properly soil sample and manage samples for quantifying soil health metrics; 2) physically quantifying soil health indicators within a laboratory setting; 3) learning proper laboratory tools and techniques; 4) understand the importance of identifying/quantifying targets of soil health; 5) learning about the Colorado Collaborative for Healthy Soils; and, 6) if time allows, working with PIs Ippolito and Machmuller to discuss statistical findings and data interpretation (Note on time: it can take 3-4 months to complete all soils analyses). The student will also be intimately linked to the overall project, and thus will have their name as co-author on any manuscript that comes from this research.

8. Dr. Ippolito has an open door policy – if the office door is open, you are welcome to come in at any time. He is also available at almost any given time via phone, Zoom, Teams, etc. Ms. Kandis Diaz (his lab manager/technician), performs daily soil health laboratory operations, will guide the intern with routine analyses, while Dr. Ippolito, Dr. Machmuller, and the visiting Egyptian scholar will mentor the student with respect as to why we measure various soil health indicators. In the case of Dr. Ippolito – if students has laboratory experience, he guides them in the project direction, with some hands on in order to ensure goals are being met, and then more of a hands-off approach is followed. Students should be able to learn, as well as make mistakes along the way, in order to problem solve and achieve goals.

9. If an overnight stay is warranted at a given location, travel funds will be made available to cover hotel and per diem. Most locations will not require an overnight stay. However, long field sampling days likely will occur.