Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19632

Elucidating anthropogenic impacts to soil organic matter composition and dynamics with integrative molecular biogeochemistry - *C.C. Patterson Medal Lecture*

MYRNA J. SIMPSON

University of Toronto

Presenting Author: myrna.simpson@utoronto.ca

Soil organic matter is a critical component of terrestrial ecosystems because it is vital for maintaining soil fertility and overall ecosystem health. Soil organic matter is also a major global carbon sink with twice as much carbon stored in soils compared to CO_2 in the atmosphere. However, global environmental change and anthropogenic activities have impacted the intricate balance between soil carbon stored versus respired which is reducing soil carbon storage globally. Soil organic matter is a heterogeneous mixture of compounds from various plant and animal/microbial sources which participate in a range of biogeochemical reactions in soils. The complex geochemistry of soil organic matter is confounding our understanding of anthropogenic impacts, such as warming, increased nitrogen deposition and changes in carbon inputs, to terrestrial ecosystems. To circumvent these challenges, an integrative molecular-level platform has been developed that incorporates nuclear magnetic resonance spectroscopy along with targeted biomarker analysis via gas chromatography-mass spectrometry to better understand how soil organic matter chemistry is altered along with microbial drivers of substrate use. This presentation will provide an overview of these challenges, how these integrative approaches can provide a more informed assessment of biogeochemical processes as they relate to soil organic matter composition and microbial processing of available substrates. Results from several long-term ecological studies will be highlighted to exhibit how integrative molecular approaches foster a deeper understanding of soil carbon biogeochemical processes with global environmental change. These approaches are disentangling the complex processes related to soil organic matter reactivity and function and are paramount to developing a mechanistic and fundamental understanding of soil carbon stability in a changing world. This knowledge will in turn facilitate more informed mitigation practices for the protection of soil carbon resources around the globe.