Integration of Biogeochemistry and Genomic Datastreams for Interpetation of Ecosystem Robustness

NANCY J. HESS[1], LEE ANN MCCUE[2], ALEJANDRO HEREDIA-LANGNER[3] AND VANESSA L. BAILEY[4]

[1]EMSL, Pacific Northwest National Laboratory, Richland WA 99352 (nancy.hess@pnnl.gov)
[2]FCSD, Pacific Northwest National Laboratory, Richland WA 99352 (leeann.mccue@pnnl.gov)
[3]NSD, Pacific Northwest National Laboratory, Richland WA 99352 (alejandro.heredia-langner@pnnl.gov)
[4]FCSD, Pacific Northwest National Laboratory, Richland WA 99352 (vanessa.bailey@pnnl.gov)

The focus on ecosystem stress and climate change is currently relevant as researchers and policymakers strive to understand the ecosystem consequences of climate change. Successful development of chemical/molecular profiles that link soil microbiology with soil carbon to ascertain soil vulnerability and resilience to climate change would have great impact on assessments of soil ecosystems in response to global climate change. Additionally these integrated signatures could be used to support the design of sustainable agricultural and food/energy crop security practices.

It is known that the structure and function of the native microbial community is intimately linked to soil carbon by both the deposition of new soil carbon and respiration of existing soil carbon as part of the terrestrial ecosystem carbon cycle. We are in the process of developing tools to assess the vulnerability of the soil carbon reservoirs to changing climate conditions and the impact on microbial community structure and function by integrating the key chemical and molecular signatures of the microbial community and soil carbon chemistry.

We demonstrate this approach using a 17 year reciprocoal transplant experiment in which soil cores were relocated between cooler-moister and hotter-drier conditions along an elevation gradient in Eastern Washington State. We have recently re-sampled this experiment to determine the long-term effects of this environmental change on the carbon biogeochemistry using high resolution mass spectometery of soil organic matter and on the microbial community using genomic and enzyme assays and present unique perspective of how long-term climate manipulation can impact the microbial and soil carbon aspects of ecosystem robustness.