Carbon Tracking for Climate Resilience

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Background/Objectives. Soils play a central role in the global carbon cycle. The dynamics of carbon uptake and release can be tracked with emerging techniques that can quantify carbon distributions [1, 2]. More accurate knowledge of how carbon concentrations change over time in selected ecosystems and managed land can inform actions for improved land management and provide inputs to climate models.

Approach/Activities. Accurate and non-destructive tracking of carbon in soil is a technical challenge that we are addressing using tools that we are adapting from a context of applied physics experiments [1, 2]. We use neutrons in the associate particle technique to image and quantify carbon distributions in soils in three dimensions. The technique is non-destructive and we have achieved a spatial resolution on the few cm scale to date with a linear response function to carbon concentrations in the relevant range of 0 to 10% in soils.

Results/Lessons Learned. We have learned that tools and techniques from applied physics can open new vectors of observation in climate science. But they also need to be developed and integrated in a systems approach so that they can be transitioned from isolated laboratory proof-of-concept demonstrations to broad field use. Adaptation and integration of these tools and techniques can significantly expand the knowledge base available to climate science for the development of increased climate resilience and inform actions in areas including land management and advanced agriculture.

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References:

[1] Mauricio Ayllon Unzueta, Bernhard Ludewigt, Brian Mak, Tanay Tak, and Arun Persaud, “An all-digital associated particle imaging system for the 3D determination of isotopic distributions”, Review of Scientific Instruments 92, 063305 (2021); https://doi.org/10.1063/5.0030499
[2] https://ibt.lbl.gov/projects/carbon-in-soil