## LC3M Progress in 2021-22

iSEE partners with the Leverhulme Centre for Climate Change (LC3M) at the University of Sheffield to investigate Enhanced Rock Weathering (ERW), a method for removing CO<sub>2</sub> from the atmosphere. Since 2016, crushed basalt rock has been applied to corn, soy, and miscanthus fields at the University of Illinois Energy Farm to measure the potential of Midwestern

croplands to act as sinks for atmospheric CO<sub>2</sub>, while still supporting the agriculture critical to the region. Second-phase LC3M funding for the Illinois project began in 2020-21.

In addition, the iSEE-led <u>SMARTFARM project</u> will contribute a portion of its \$8.15 million in U.S. Department of Energy Advanced Research Projects Agency-Energy (ARPA-E) grants toward a new "MiniFACE" CO<sub>2</sub> enrichment component of the LC3M project.

The enhanced rock weathering project at the University of Illinois Energy Farm has expanded to include a CO<sub>2</sub> enrichment experiment called "RockFACE" under the guidance of Lisa Ainsworth and the researchers at the SoyFACE site. Eight "MiniFACE" rings have been constructed to



Technician Mike Masters collects soil water from PVC wells installed in maize fields at the University of Illinois Energy Farm.

compare the effects of basalt with and without  $CO_2$  enrichment mimicking future climate projections for atmospheric  $CO_2$ . Responses will show if higher atmospheric  $CO_2$  drives increased  $CO_2$  capture by enhanced weathering.

To visualize the progression of physical weathering, basalt-filled mesh bags were buried in the Energy Farm research plots in 2021 and at RockFACE in 2022 to expose the basalt grains to the weathering effects of the soil and plant environment. Bags will be removed after 1, 2, and 3

years and examined by X-ray powder diffraction (XRD).

Following the successful sampling and sequencing of basalt-treated soybean in 2019, maize soil and roots were collected in July 2020 for molecular sequencing with the intent of understanding the composition and dynamics of the microbial community, and how these change with crop rotation. This component of the project seeks to understand the suppression of N<sub>2</sub>O production after basalt application by identifying the microbial drivers of



Corn roots sampled for carbon and nitrogen calculations at the Energy Farm.

nitrogen cycling in the soil and plant root zone. This project is being repeated at RockFACE in 2022.

Illinois researchers contributed to one new publication in 2021-22:

 Kantola, I.B., Masters, M.D., Blanc-Betes, E., Gomez-Casanovas, N., DeLucia, E.H. (2022) "Long-term yields in annual and perennial bioenergy crops in the Midwestern United States." <u>GCB Bioenergy</u> 14, 694-706.