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The Deep Soil Ecotron: Extending the Boundaries of Biogeochemical Research

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The Deep Soil Ecotron (DSE) is the first modern ecotron facility in the United States designed for controlled and replicated experiments of soil processes down to three meters in depth. Comprised of 24 highly instrumented and independently controlled ecounits, the DSE will allow unprecedented manipulation of biophysical conditions and continuous monitoring and repeated sampling of volatiles, fluids, and soil mineral and biological components over entire soil profiles. Capabilities for manipulating biophysical conditions independently across three soil zones and plant canopy will enable new research on whole-system response to change that links reactions and interconnections across the entire critical zone.

Four key scientific questions drove the design of the DSE: (1) how do deep soil microbial communities and processes interact with surface layers to influence whole-ecosystem function; (2) how do subsurface systems respond to global and land-use changes; (3) how can we improve the representation of biogeochemical processes in models through new data integration; and (4) how can we best leverage the DSE capabilities for development and testing of novel *in-situ* sensors designed for deep soil environments?

This facility is now available for collaborative, community-driven research. State-of-the-art cyberinfrastructure will support remote experimental control and data access in real time to foster team research at a national scale. Beyond its technical capabilities, the DSE will serve as a platform for community engagement spanning science, industry, education, and the arts. Upcoming workshops will support research participation, sensor development, modeling, and data accessibility. The project team is committed to making the DSE an inclusive space for interdisciplinary innovation and training the next generation of researchers and project managers in mid-scale infrastructure.

This presentation will provide an overview of the DSE's design, experimental capabilities, and participation opportunities.