



Digital Dirt Growing Carbon Farming's Potential Through Better Data

Regenerative agriculture restores the health of soils, offers additional revenue for farmers, and provides an opportunity to address climate change by storing enough carbon each year to meet 10% of the world's Paris Climate Accord commitments. Pecan Street's Digital Dirt initiative is exploring new methods to accelerate market development for carbon farming.

Our Role

Thanks to Pecan Street Inc.'s unique energy and water research network, researchers know more about individual energy and water use than ever before. Our hundreds of volunteer participants – and the billions of records that power our online database – have fueled insights by more than 2,000 researchers in more than 60 countries and resulted in more 200 peer-reviewed publications (see pecanstreet.org/work/papers/).

The same data gap that Pecan Street eliminated for energy and water data exists today in soil and agriculture science, hobbling farmers' ability to harness the full value of their land and the co-benefits of ecosystem and climate services. To help overcome this barrier, Pecan Street is applying its expertise in data collection, machine learning, big data management and public-private research collaborations to advance solutions that promote rapid, widespread adoption of regenerative farming practices.

Several public and private initiatives now encourage the adoption of carbon farming practices. But they all share a lack of a recognized methodology to sample and monitor soil carbon content over time. These data are critical for verifying practices and building markets for these services. To be successful, the collection and analysis of these data need to be simple, secure, cost-effective, and time-efficient.

Our Thesis

Regenerative agriculture is a largely untapped opportunity to reduce GHG emissions and add new revenue streams for farmers. Consistent data collection standards for soil sampling, modernized measurement and verification methods, and an integrated open-platform data management solution are essential for building more robust marketplaces for carbon farming. Crucially, this must be done while protecting farmers' privacy and profitability.

Pecan Street's Digital Dirt Initiative

Pecan Street's Digital Dirt initiative is exploring new methods to accelerate market development for carbon farming. A newly awarded grant is supporting Pecan Street's efforts to convene scientists at Texas A&M University, Cornell University, Colorado State University, the Texas Advanced Computing Center (TACC), and the 4p1000 Initiative. The team will investigate remote sensing technologies and methods of data integration to accelerate widespread regenerative agriculture adoption for rapid draw down of atmospheric carbon dioxide.

We are evaluating open-platform innovations for soil carbon sequestration that align with the values and needs of farmers. Digital Dirt is identifying new methods for enhancing existing soil assessment tools with high volumes of new sensor data and exploring applications for Artificial Intelligence (AI) and Machine Learning (ML) to predict how soil management practices affect carbon storage in soils. To unlock the potential for AI and ML to leapfrog current state-of-the-art soil health and carbon sequestration M&V, Pecan Street is convening an AI for Soil Carbon M&V working group in partnership with the Texas Advanced Computing Center (TACC).

Pecan Street is uniquely qualified to spearhead these efforts. Our team will provide data collection and management services to help standardize soil carbon data collection, design databases optimized for research, and establish APIs for third party technologies. We will also foster connections with entrepreneur ecosystems to accelerate market solutions for farmers.

Pecan Street's data platform, Dataport (pecanstreet.org/dataport/), will be expanded to

include soils datasets that will enable other researchers to leverage these existing features:

- Licensing structure for free and fee-based access
- EU GDPR compliant privacy and cybersecurity policies developed in partnership with the National Energy and Technology Laboratory
- An open-platform PostgreSQL database structure hosted on secure servers at Pecan Street's lab and backed-up by Amazon Web Services
- Easy-to-use data querying website enables researchers without any database or programming experience to understand and visualize datasets
- Existing APIs for easy data integration
- Team of data scientists and DevOps managers can integrate datasets
- Coming soon: a JupyterHub environment to facilitate replicable research and collaboration

Additionally, Pecan Street's lab supports sensor innovations and advanced measurement development for novel soil carbon and nitrogen measurement. We have worked with dozens of companies on cleantech product development in our lab and testbeds. We also developed and operate a Department of Energy-funded program called PLATFORM for Product Launch, which provides third-party product performance testing and environmental impact quantification.

For additional information, please contact Pecan Street at soils@pecanstreet.org.