

Farming for the Future

Carbon sequestration is an important strategy to reduce the quantity of carbon dioxide in the atmosphere and advance agriculture.

In relation to climate change, carbon sequestration is the temporary or permanent removal of CO₂ from the atmosphere. This removal can be natural via photosynthesis and subsequent soil organic matter storage or industrialized via carbon capture mechanisms, e.g. CO₂ scrubbing. Sequestration is dependent on geography, climate, and soil types. (Morgan et al., 2010)

Wood, plant tissues, soil, and root systems can **sequester carbon**. (Searchinger, 2020)

Soils are a **large and active** carbon sink when land is regenerated. (FAO, 2020); (Powelson et al., 2011)

CO₂ is one of the most **significant** greenhouse gases forcing **climate change**. (ESRL, 2021)

CO₂ is increasing **faster** than plants can absorb through photosynthesis. (ESRL, 2021)

The **exchange** of CO₂ between the atmosphere and plants accounts for one of the **largest fluxes** in the global carbon cycle. (ESRL, 2021)

Carbon Sequestration Strategies



Diversify Agriculture: Rotating between crop and pasture, cover cropping, utilizing organic amendments (i.e. compost), and agroforestry are strategies to limit soil disturbance and enhance carbon capture of agricultural systems. (Searchinger, 2020)



Utilize Carbon Sources: Compost is an excellent carbon stabilizer for soils and a source of plant nutrients. Biochar is a resistant carbon source that can improve soil functions. Cover cropping allows carbon capture directly in fields. (Bai et al., 2019; Franzluebbers, 2010)



Employ Sustainable Soil Management (SSM): Strategies that improve soil functions and increase soil carbon levels can enhance food security, increase farm incomes, and ultimately mitigate climate change. When organic matter accumulates in soil, carbon dioxide is removed from the atmosphere. (FAO, 2019) (Franzluebbers, 2010)

Farming for the Future



NCLFC Member Related Work:

- **NC Farm Bureau** and the Food and Agriculture Climate Alliance provide policy recommendations focused on carbon sequestration.
- **The North Carolina Department of Agriculture and Consumer Services** offers the Agricultural Development and Farmland Preservation Fund which helps individuals preserve their farms, forests, and natural lands on their properties. Maintaining and preserving these lands contributes to increased carbon sequestration.
- **NC Cooperative Extension** shares research and resources on a range of topics including carbon sequestration and other climate mitigation and adaptation strategies.
- **NC State's Agroecology Education Farm** offers a variety of programs and resources to build sustainable agriculture knowledge by integrating ecology and agriculture.
- **Carolina Farm Stewardship Association (CFSA)** offers free consulting services for its members. This includes conservation activity plans and implementing organic production practices, both of which can contribute to improved carbon sequestration.
- **The Sustainable Agriculture Conference** by CFSA includes a variety of workshops ranging from regenerative agriculture and soil health to building climate resilience.

CEFS Related Work:

- **The Agroforestry Research Unit at Cherry Research Farm** is investigating the carbon storage potential from both timber and soil organic matter in a silvopasture system, i.e. growing trees and pasture together.
- **The Farming Systems Research Unit** is investigating long-term soil organic matter changes under organic, integrated crop livestock (livestock on land at some point during the year), timber, and conventional agricultural practices, as well as agricultural abandonment (intentional or unintentional giving away of land for natural growth) to determine carbon sequestration potentials.
- **The Agroforestry and Pasture-Based Beef Units** are testing forage species and grazing strategies to assess soil carbon sequestration. Farmers are trained in improved pasture and grazing management through the **Amazing Grazing Program**, and in collaboration with **NC Choices**, an initiative that also supports the development of markets for pasture-raised local meat.
- **On-Farm Agricultural Management Studies** are being conducted to assess soil health and soil carbon sequestration.

Other Related Work:

- **The State of North Carolina** released The North Carolina Natural and Working Lands Action Plan as part of their Climate Risk Assessment and Resiliency Plan, highlighting carbon offset programs as a strategy for landowners and farmers to reduce carbon emissions.

References

- Bai, X., Huang, Y., Ren, W., Coyne, Mark, Jacinthe, P.-A., Tao, B., Hui, Dafeng, Yang, J., & Matocha, C. (2019). Responses of soil carbon sequestration to climate-smart agriculture practices: A meta-analysis. *Global Change Biology*, Volume 25. Issue 8, 2591–2606. <https://doi.org/https://doi-org.prox.lib.ncsu.edu/10.1111/gcb.14658>
- ESRL. (2021, January 15). N. Retrieved from ESRL Global Monitoring Laboratory - Education and Outreach: https://www.esrl.noaa.gov/gmd/education/carbon_toolkit/basics.html
- Food and Agriculture Organization of the United Nations. (n.d.). Soil Organic Carbon And Nitrogen Reviewing The Challenges For Climate Change Mitigation And Adaptation In Agri-food Systems. Food and Agriculture Organization of the United Nations. <https://doi.org/https://doi-org.prox.lib.ncsu.edu/10.1111/gcb.14658>
- Food and Agriculture Organization of the United Nations. (2020). Technical specifications and Country guidelines for Global Soil Organic Carbon Sequestration Potential Map (GSOCseq). Rome
- Franzluebbers, A. J. (2010). Achieving Soil Organic Carbon Sequestration with Conservation Agricultural Systems in the Southeastern United States. *Soil Science Society of America Journal*. Volume 74. Issue 2, 347-357
- Jack A. Morgan, Ronald F. Follett, Leon Hartwell Allen, Stephen Del Grosso, Justin D. Derner, Feike Dijkstra, Alan Franzluebbers, Robert Fry, Keith Paustian, Michele M. Schoeneberger
Journal of Soil and Water Conservation Jan 2010, 65 (1) 6A-13A; DOI: 10.2489/jswc.65.1.6A
- Powelson, D. S., Whitmore, A. P., & Goulding, K. W. T. (2011). Soil carbon sequestration to mitigate climate change: a critical re-examination to identify the true and the false. *British Society of Soil Science*. Volume 62. Issue 1, 42-55. <https://doi.org/https://doi-org.prox.lib.ncsu.edu/10.1111/j.1365-2389.2010.01342.x>
- Searchinger, T. A. (2020). INSIDER: Further Explanation on the Potential Contribution of Soil Carbon Sequestration on Working Agricultural Lands to Climate Change Mitigation. Retrieved from <https://www.wri.org/blog/2020/08/insider-further-explanation-potential-contribution-soil-carbon-sequestration-working>