

Carbon Sequestration in Croplands



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Highlights

- Soil carbon sequestration and greenhouse gas mitigation is possible in arid and semiarid croplands.
- Soil organic matter increases with improved agricultural practices.
- Water limitation is the main barrier to carbon sequestration in arid and semiarid environments.
- Optimal economic incentives to farmers and landowners can drive success in carbon sequestration.

Carbon sequestration in croplands involves capturing atmospheric carbon through photosynthesis and ultimately storing that carbon in the ground as soil carbon. Carbon sequestration and greenhouse gas emissions mitigation can occur through a variety of agricultural practices. Here, we provide an overview of cropland management practices and discuss possible options for increasing soil carbon.



Improved soil, crop, nutrient, and water management practices can increase soil carbon in croplands. Agricultural practices that build soil organic carbon stocks can also improve soil health, mitigate greenhouse gas emissions, and support the development of climate neutral farming systems. Through demonstration of soil, crop, and water management practices for resource use efficiency, agronomic productivity, economic potential, and environmental footprints, NMSU can support farmers in identifying a viable carbon sequestration pathway while maximizing crop production.

Soil Health and Carbon Management Practices in Croplands

- **Reduced and no-tillage:** reduced and no-tillage management protect carbon from oxidation. They also increase soil aggregation and aggregated associated carbon.
- **Crop intensification and diversification:** cover cropping, crop rotation, intercropping of deep and shallow-rooted crops, and perennial cropping add biomass carbon to soil and increase carbon sequestration. Diverse crops diversify microbial substrate and increase the sequestration efficiency.
- **Soil amendments:** amendments, such as compost and biochar, applications improve water retention, reduce soil density, improve infiltration, and increase nutrient retention in soils.
- **Improved nutrient management:** adoption of 4R nutrient strategies, precision nutrient management, etc. increase crop production, improve soil carbon accumulation, and soil health.
- **Livestock-integrated agriculture:** livestock grazing facilitates carbon cycling within a field by utilizing biomass and converting them into manure and spreading in the field.

Resources, Technology and Socioeconomic Interventions

Utilizing scarce water resource: Water is the main limiting factor for carbon sequestration in arid and semiarid regions. NMSU research on brackish water utilization technology provides an avenue for harnessing carbon sequestration in degraded lands. Integrating water conservation technologies, using water-efficient crops and varieties, and utilizing produced water for biomass crop production will help achieve “more carbon per drop” in arid and semiarid areas.

Artificial intelligence in agriculture: Artificial intelligence has emerged as a potential tool for increasing food production while simultaneously minimizing resource use and improving environmental quality. Adoption of technologies for improved nutrient and water use efficiency can harness “more carbon per unit farm inputs.”

System approach in carbon management: A food systems research approach is needed to make effective long-term decisions about needs and solutions for carbon sequestration in the agriculture sector.

Policy and socioeconomic interventions: Optimal economic incentives to farmers and landowners can drive the success of carbon sequestration. Dramatic changes to current agricultural land use will require the consent of landowners. By providing incentives, farmers and landowners will be motivated to adopt sustainable carbon sequestration practices on a large scale, transforming agricultural production. Tools must be developed to estimate carbon sequestration and climate mitigation potential of croplands.

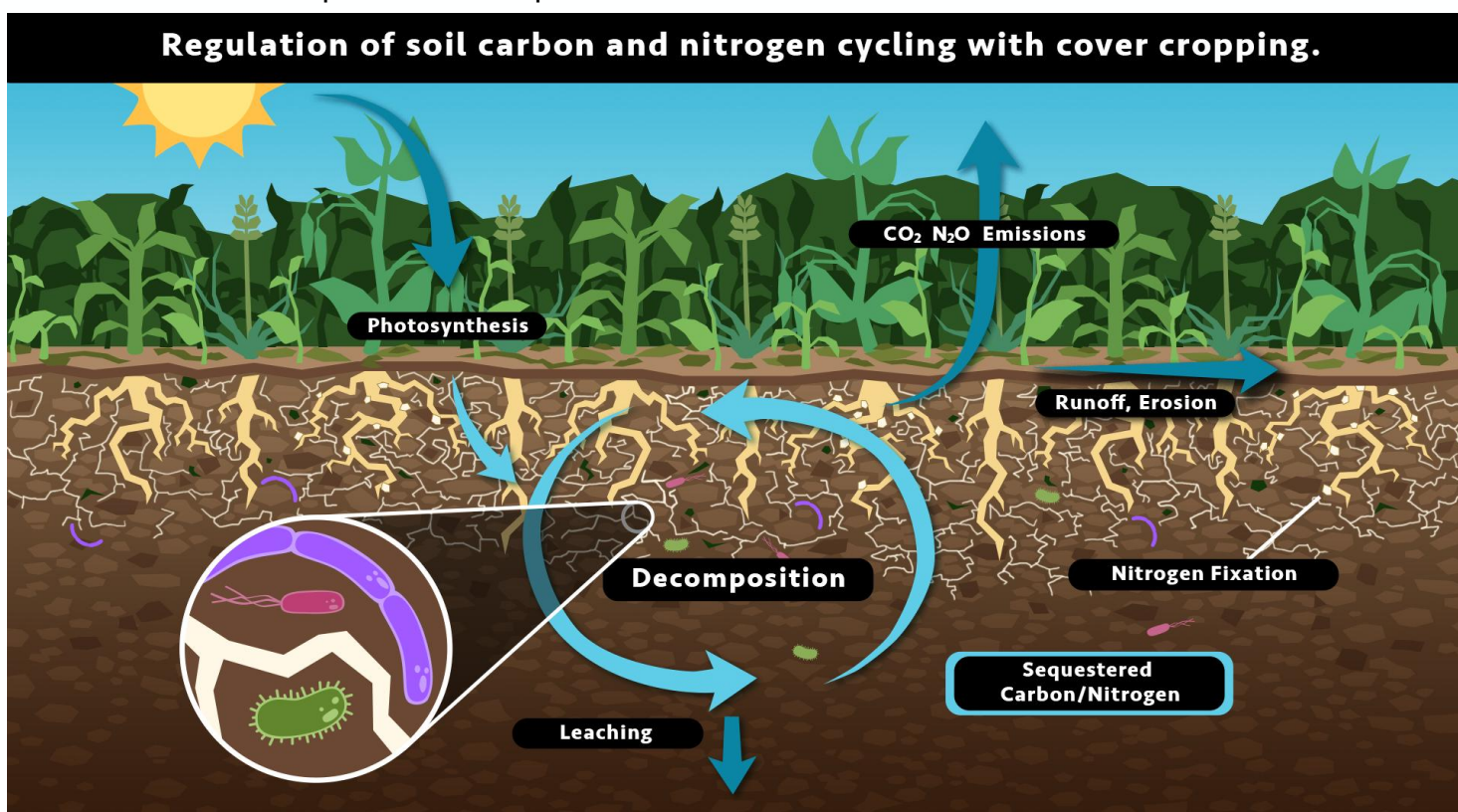


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