Agricultural land in the United States has the capacity to sequester about 650 million metric tons of carbon dioxide (CO₂) every year, offsetting up to 11% of U.S. greenhouse gas (GHG) emissions annually (Lal et al., 2003). Of this amount, cropland accounts for about 41%, grazing land 24% and forest lands 36%. Farmers, ranchers, and foresters, implementing best management practices (BMPs) such as cover crops, no-tillage, and nutrient management, play an important role in sequestering carbon. Voluntary carbon trading markets like the Chicago Climate Exchange (CCX) currently pay these land managers between $2 and $3 per acre for adopting proven technologies (conservation tillage and grass and tree planting) for sequestering CO₂. In addition to providing farmers with another source of income, carbon sequestration increases soil organic carbon which improves productivity, reduces soil erosion and nutrient runoff, and enhances water quantity and quality. Soil carbon sequestration is a win-win solution for agriculture and the environment.

How is Carbon Sequestered?
Plants cultivated to produce food, feed, fiber, and fuel, use CO₂ from the atmosphere in photosynthesis to grow. Upon harvest, decomposing plant residues (including roots) are, in addition to being a source of nutrients for subsequent crops, a sink for atmospheric carbon. Soil carbon sequestration occurs when the carbon from decomposing residues is converted in the soil to humus or soil organic carbon (SOC). Farmers, ranchers and foresters can employ carbon-sequestering BMPs, including cover crops, buffer strips, conservation tillage, no-tillage, selective harvesting, and planting of grasses, to ensure sustainable yields and protect land and water resources while, at the same time, offsetting GHG emissions.

How much Carbon Can be Sequestered in the Soil by Agriculture?
In the U.S. each year, adoption of BMPs can lead to sequestration of 83-270 million metric tons of carbon (or a mean of about 650 million metric tons of CO₂). From the cropland portion totaling 72 million metric tons of carbon (264 million metric tons of CO₂), 50% can be due to conservation tillage and surface residue management, 25% to adoption of improved cropping systems and other BMPs, 6% to supplemental irrigation and the remainder to other practices. No-till farming, an especially promising method which leaves the soil intact and crop residues in the field, sequesters an average of 0.3 metric tons of carbon per acre per year.

What are the Economic and Environmental Benefits of Soil Carbon Sequestration?
Carbon markets offer farmers financial incentives while providing binding contracts to businesses that wish to voluntarily offset their CO₂ emissions. The CCX pays land managers between $2 and $3 per acre for sequestering CO₂ using certified conservation tillage practices and/or grass and tree planting. Voluntary carbon markets show great promise as a vehicle to improve stewardship and mitigate climate change.

Of the many mitigation options available to reduce greenhouse gases, SOC sequestration is the most readily deployable, environmentally beneficial and a low-cost means of reducing US GHG emissions. Soil carbon sequestration provides a bridge to the future, allowing the U.S. economy time and “breathing room” as we transition to less-GHG intensive energy production technologies.

Increasing SOC improves soil quality, boosting agricultural productivity while reducing atmospheric CO₂ concentrations. In addition, because carbon stored in agricultural soils can be easily quantified using well-accepted scientific practices, it can provide benefits to farmers through rental payments and to society by avoiding the cost of implementing expensive new technologies. More research is needed to ensure that farmers have access to improved carbon management technologies and that markets adequately reward their conservation efforts.
Best Management Practices

Cropland
- Reduced tillage
- Rotations
- Cover crops
- Fertility management
- Erosion control
- Irrigation management

Grasslands
- Grazing management
- Fire management
- Fertilization

Forest
- Selective harvesting
- Tree planting
- Diverse Species

Soil Carbon Sequestration is Greatest with:

Northwestern USA
- Conservation tillage
- Cropping systems without fallow periods

Northeastern USA
- Conservation tillage

Central USA
- Conservation tillage
- Complex cropping rotations

Southwestern USA
- Rangeland restoration
- Less intensive grazing

Southeastern USA
- Conservation tillage
- Cover crops
- Pasture management

Facts about Soil Carbon

- World wide, C in the surface meter of soil comprises about fl of the C on land.
- Best Management Practices (BMPs) vary due to climatic conditions and soil type.
- Carbon is found in diamonds, pencil lead, gasoline, and soil!
- In Western States, soil inorganic carbon is abundant in the parent material

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Merle Holle
M & K Farms near Marysville, KS

Mr. Merle Holle is a no-till grain and soybean
farmer in Kansas’s 1st Congressional district.
Mr. Holle has farmed the land on M & K
Farm since 1956, where it has been passed
through the hands of two generations.
He now grows corn, soybean, wheat, and
grain sorghum with his son on the land
in Marysville, KS and has practiced no-till for
16 of his 60 years of farming. After the
first 5 years of no-till, Mr. Holle has never
looked back to conventional, citing the many
benefits of no-till. Mr. Holle participates
in the Chicago Climate Exchange (CCX)
program for soil offsets through the Kansas
Coalition for Carbon Management.