Carbon Farming

Photos courtesy of Marin Carbon Project and Stemple Creek Ranch

INCREASING FERTILITY & WATER HOLDING CAPACITY PROVIDING SOLUTIONS FOR CLIMATE CHANGE

What Is Carbon Farming?

Carbon Farming involves implementing on-farm practices that increase the rate at which plants transfer carbon dioxide (CO_2) from the atmosphere to the soil, increasing both productivity and soil organic matter (SOM). Carbon Farming is a process to maximize the farm or ranch potential for contributing to the removal of excess green house gases from the earth's atmosphere while building farm fertility, productivity and resilience .

Carbon farming is the process by which agriculture engages with plant photosynthesis to increase the rate of carbon dioxide movement out of the atmosphere and into the plant, where it is transformed into agricultural products such as food, flora, fuel or fiber. The goal of Carbon Farming is to move more carbon dioxide from the atmosphere into plants and soils than is emitted through farming activities.

Carbon Farming practices enhance terrestrial carbon, whether in plants or soils, and this drives beneficial changes in other system attributes, including hydrological function, biodiversity, ecosystem resilience and productivity.

Where would Carbon Farming occur?

Carbon Farming practices are implemented on working lands, including agricultural lands and grasslands. Grassland soils, including rangelands and pastures, are widely recognized for their potential to sequester carbon due to their extensive land cover. Grasslands cover approximately 31% of the land area in the United States and approximately 50% of the state of California (Silver et al, 2010), but arable lands also have significant—and perhaps greater—carbon storage potential. Care must be taken to apply practices appropriate to sensitive ecosystems. Riparian corridors are another land type that when revegetated provide significant greenhouse gas mitigation and sequestration (Lewis et al, 2015).

What are Carbon Farm practices?

Carbon Farm practices are those known to increase plant biomass and build soil organic matter. When practices are combined in a whole farm planning approach, the net impact is significantly greater than when practices are implemented in isolation. A list of Carbon Farm practices can be found on the next page.

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COMET-Planner 2015 Carbon Farm practices

- Conventional Tillage to No-Till
- Improved Nutrient Management
- Conservation Crop Rotation
- Cover Crops
- Strip Cropping
- Alley Cropping
- Multistory Cropping
- Combustion System Improvement (Improved Fuel Efficiency of Farm Equipment)
- Critical Area Planting
- Riparian Restoration
- Forage and Biomass Planting
- Herbaceous Wind Barriers
- Vegetative Barriers
- Riparian Herbaceous Cover
- Contour Buffer Strips
- Field Border
- Filter Strip
- Grassed Waterway
- Tree/Shrub Establishment
- Windbreak/Shelterbelt Establishment
- Windbreak/Shelterbelt Renovation
- Riparian Forest Buffer Establishment
- Hedgerow Planting
- Range Planting
- Silvopasture Establishment on Grazed Grasslands
- Mulching
- Increasing plant growth on pastures and croplands with Compost Addition
- Prescribed Grazing

Has the efficacy of Carbon Farming been demonstrated?

One Carbon Farm practice that has been tested extensively by UC Berkeley in California's soils is the application of compost on rangelands. It has been demonstrated that a one-time application of a one-half-inch layer of compost on grazed rangeland increased long term carbon storage by 1 ton of C per hectacre and forage production increased by 40-70% (Ryals and Silver 2013). Recent results from the U C Extension Creek Carbon study show that one kilometer of mature, restored riparian corridor contains as much as 748 tonnes of soil carbon and 3,671 tonnes of woody vegetation carbon—above baseline conditions (Lewis et. al).

In addition to compost, there are thirty-five on-farm NRCS conservation practices that are known to improve soil health and sequester carbon while producing other important environmental co-benefits and improving the resilience and ecological sustainability of working landscapes. Studies have also shown that farms that utilize carbon-conscious agricultural techniques can be more profitable than those that maintain a more conventional agricultural management style (Howitt et al., 2009; Jones, 2011).

Photos courtesy of Marin Carbon Project, Stemple Creek Ranch, CarbonFarmersofAmerica.org

How is it a climate change solution?

Carbon Farming helps to mitigate climate change by increasing the amount of captured carbon held or 'sequestered' in soils, wood, plant roots, leaves and stems, which reduces the amount of carbon dioxide in the atmosphere. For example, the one kilometer creek restoration mentioned above offsets greenhouse gas emissions equivalent to removing 3,411 passenger cars from the road (US EPA, 2015). If all of California's 38 million acres of rangelands were to receive a one-half-inch layer of compost, the net impact of this practice would mitigate all of California's residential, commercial and livestock emissions (CA ghg inventory, 2010).

How does compost application on rangelands increase soil carbon?

Compost is decomposed organic matter that is rich in carbon, organic nutrients and water holding capacity. When added to soils, compost increases the soil carbon and nutrient content, increasing soil moisture holding capacity. This enhances plant growth, as reflected in plants' ability to pull more CO_2 from the air through their leaves, into their roots and into the soil, further increasing the soil's carbon content. Farmers and ranchers have used compost for centuries to help increase soil health and fertility—but until recently, scientists had not measured the effect of compost on increased plant-derived soil carbon over time.

How do the emissions associated with applying compost to rangelands fit into the solution?

Activities related to the production, transportation and application of compost on rangelands also generate green house gas emissions. We conducted a comprehensive Life Cycle Analysis of compost application on rangelands. We found that the carbon sequestration that occurred far exceeded the emissions related to the compost creation and application: an additional one-ton of carbon per hectare was sequestered in these landscapes after full accounting of emissions had taken place (DeLonge et al 2014).

Besides compost application, what other Carbon Farming practices show a demonstrated soil carbon benefit on rangeland systems?

Compost application on rangelands, and riparian corridor restoration have been researched extensively in California soils. However, there are a number of other carbon farming practices that are already being implemented on working lands for land conservation purposes. With the use of quantification tools such as COMET-Farm and COMET-Planner, we are now able to estimate the carbon sequestration potential of these practices.

Who can develop Carbon Farm plans for farmers?

Carbon farm plans are being developed for a number of ranchers with the assistance of local land managers, such as Resource Conservation Districts and Land Trusts. As carbon farming develops further, it is envisaged that carbon farm plans will be completed collaboratively by farmers, Resource Conservation Districts and other qualified land managers.