Why Carbon Sequestration: Need for Action

Contra Costa County shares California's goals to create a cleaner, healthier state. Energy technologies alone — renewables and electrification — will not be enough to achieve California state goals for carbon neutrality by 2045. Fossil fuel reductions must be supplemented with decarbonization practices in order to significantly impact greenhouse gas emission reductions. Carbon can be stored long term in soils in a process called *carbon sequestration*, or *carbon farming.*

Carbon sequestration refers to practices that increase the ability of soil and plants to pull carbon from the atmosphere and sequester it deep in the soil, restoring the natural soil that organic carbon sinks. Carbon sequestration also increases water holding capacity, reduces erosion, and creates healthier soil ecosystems, making it one of the most cost-effective carbon capture strategies available.

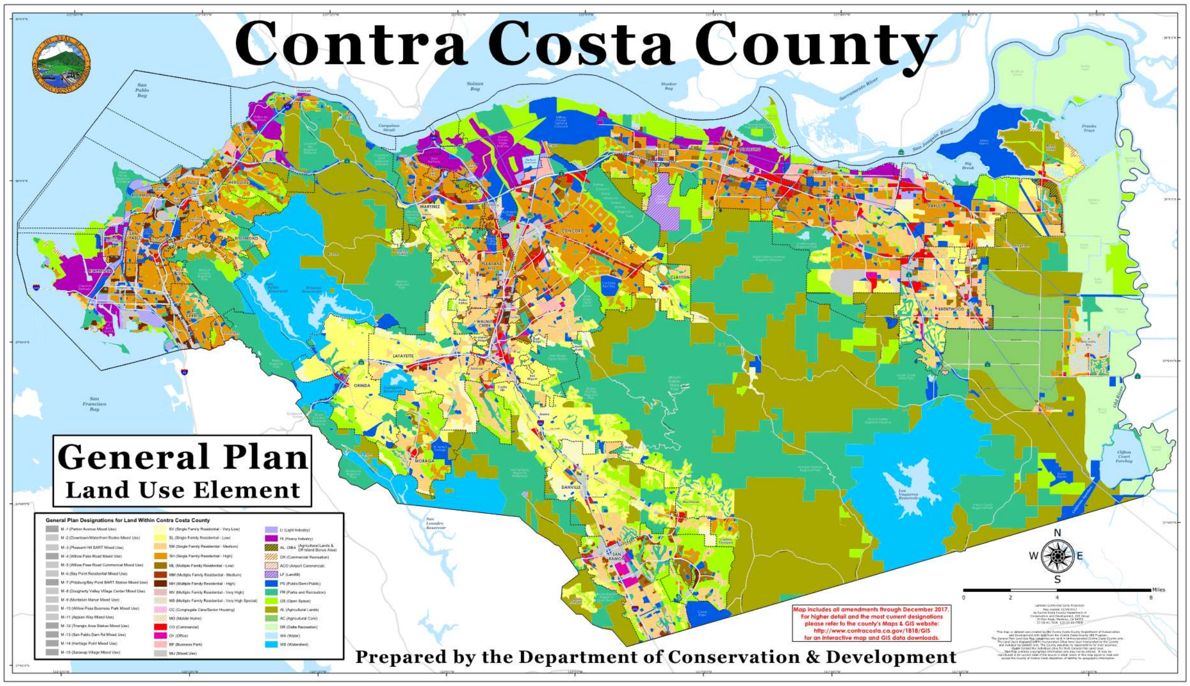
Carbon sequestration provides an opportunity to restore balance within the carbon cycle in a way that will protect biodiversity, reduce emissions, build resilience to drought, and mitigate climate change.

Applications for Sequestering Carbon

There are many management practices that can be applied to open space lands, croplands, grasslands, and grazing lands to increase soil organic carbon:

20 United States Department of Agriculture (USDA) Natural Resources Conservation Service Approved Practices for Sequestering Carbon

Forests, Trees & Shurbs	Grasslands, Pastures & Rangelands	Streams & Wetlands	Ranch Facility & Operations
• Tree/Shrub Establishment • Silvopasture Establishment on Grazed Grasslands • Windbreak/Shelterbelt Establishment • Hedgerow Planting Grass	• Range Planting • Restoring Degraded Rangeland with Compost • Prescribed Grazing • Forage Biomass Planting • Conservation Cover • Improved Nutrient Management • No Till • Field Border	• Riparian Restoration • Riparian Herbaceous Cover • Riparian Forest Buffer • Critical area Planting • Wetland Restoration • Filter Strip / Grassed Waterway	• Anaerobic Digester • Combustion System Improvement (for Farm Equipment)



Contra Costa County Land Use Map

The County's land use map identifies land with potential for implementing carbon sequestration opportunities within the County, including: open space lands, agricultural lands, parks and recreation lands, watershed lands, delta recreation, and landfills.

How effective is Carbon Sequestration?

Sequestration of just one metric ton per hectare on half the rangeland area in California would **offset 42 million metric tons of CO_2e**, an amount equivalent to the annual greenhouse gas emissions from energy use for all commercial and residential sectors in California.[1] Carbon dioxide (CO2) is naturally captured from the atmosphere through biological, chemical, and physical processes. These changes can be accelerated through better management practices and changes in land use and agricultural practices. Carbon sequestration is successful when carbon gains resulting from enhanced land management or conservation practices exceed carbon losses.

It is important to know the impacts of practices when it comes to increasing soil carbon. Measurement techniques for soil carbon can help to track changes in soil carbon. Models can be used to estimate total possible carbon sequestration from changes in management practices. Both measurement and modeling can be used to develop carbon credits or other standards and premiums that add value to good produced under healthy soil practices or in a climate-beneficial manner.

Implementation Needs and Considerations

The following are recommendations for successful implementation of carbon sequestration projects, including:

- Collaboration with multiple partners;
- Increase funding and resources for carbon sequestration;
- Coordinate cross-agency implementation;
- Prioritize capacity building, technical assistance, and collaborative planning;
- Recognize restoration economies;
- Invest in education and outreach;
- Leverage cross-sector interactions;
- Continue to support ongoing research; and
- Consider and measure carbon benefits

Moving Forward

The potential is high for finding natural and working lands solutions in Contra Costa County. Sufficient and consistent program funding is needed to scale up, accelerate, and achieve maximum carbon sequestration benefits.

Successful work is only possible with the input of numerous stakeholders, both within County government and other governmental entities, as well as external stakeholders including community organizations, environmental groups and nonprofits, local landowners, and agricultural organizations. An initial list of potential partners includes:

Agriculture Resource Conservation District UC Agriculture	Parks EBRPD Save Mt. Diablo
Rangelands East Contra Costa County Habitat Conservancy	Solid Waste RecycleMore (West Contra Costa Integrated Waste Management Authority) Central Contra Costa Integrated Waste Management Authority
Urban Agriculture Urban Tilth Watershed Project Planting Justice others to be identified	

Contra Costa County must increase its efforts to conserve, restore, and manage its rangelands, farms, urban green spaces, wetlands, and soils. We expect to continue to lose carbon from the land as a result of extreme events exacerbated by climate change, drought, wildfire, land subsidence, development, and other disturbances. Actions to protect, restore, and sustainably manage the health and resiliency of these lands can greatly accelerate our progress to mitigate climate change and our ability to reduce worsening climate change impacts.

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Appendix:

Several state agencies in California collaborated to compile the "California 2030 Natural and Working Lands Climate Change Implementation Plan," which is a blueprint for action on natural and working lands that aims to maximize climate benefits and serve other important environmental and ecological objectives, specifically, a suite of State-supported land management, restoration, and conservation activities that can be pursued to help change the current emissions trajectory and move the sector closer to becoming a resilient carbon sink.

Table 1*: Summary of Applications in the 2030 State Natural and Working Lands Climate Change Implementation Plan.*[2]

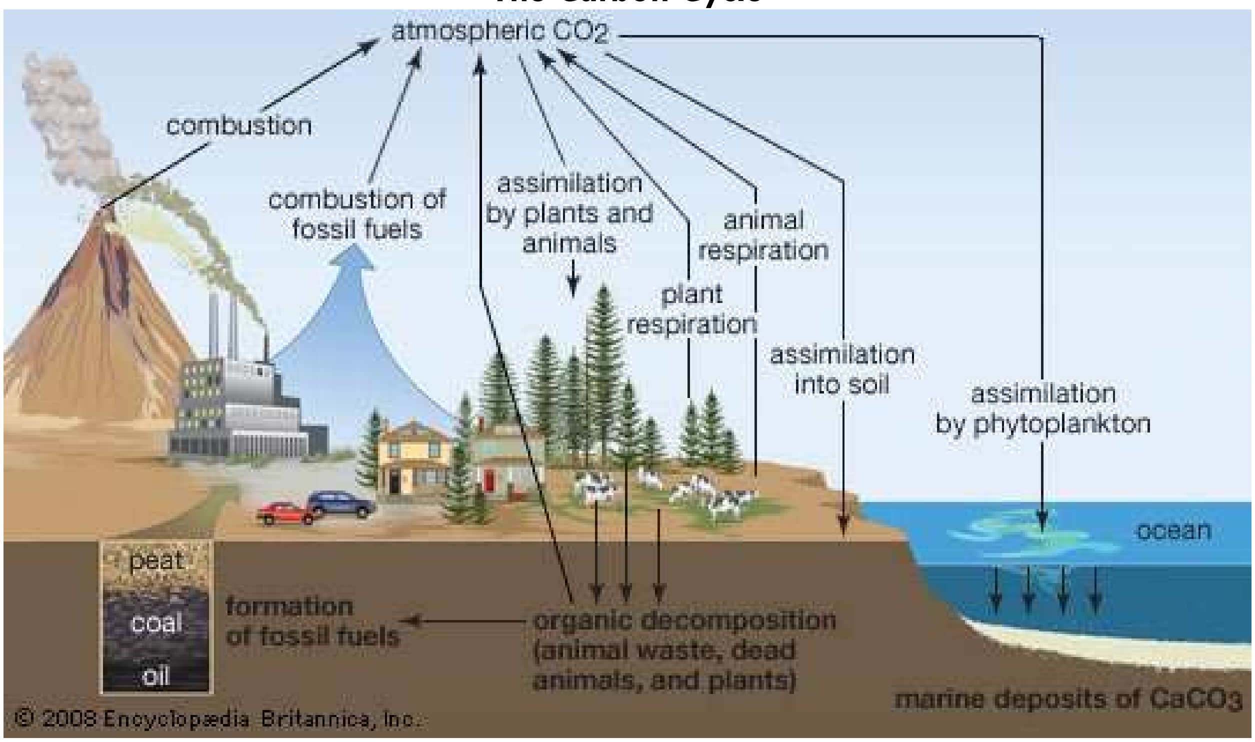
Application	Description
Conservation: avoided conversion of natural and working lands	50–75% reduction in annual rate of conversion by 2030.
Forestry: improved forest health and reduced wildfire severity, enhanced carbon in forested ecosystems, biomass utilization.	Prescribed fire, thinning, understory treatment, less intensive forest management, additional 50% of slash diverted from pile burn/decay to other uses.
Restoration	Riparian, oak woodland, coastal wetland, Delta wetland, meadow and seagrass restoration. Urban forest expansion.
Agriculture: agroforestry, cropland management, compost application	Silvopasture, hedge row establishment, windbreak establishment, riparian forest buffer, riparian herbaceous cover. Cover cropping, mulching, no-till farming, reduced-till farming. Compost application on annual cropland, perennial cropland, non-irrigated cropland, irrigated pasture.

Table 2*: Soil carbon sequestration rates under USDA Natural Resources Conservation Service (NRCS) conservation.*[3]

NRCS Conservation Practice Method	*Atmospheric/soil Benefit (mg Carbon captured per hectare) 1Mg= 1 megagram or 1 metric ton*
Conservation cover – retiring marginal soils	.42 to .94
Conservation crop rotation	.15 to .17
Residue and tillage management, no till	.15.to 27
Strip till	.07 to .17
Mulch till	.07 to .18
Contour farming	.07 to .19
Contour buffer strips	.42 to .94
Cover crop	.15 to .22
Residue and tillage management, reduced till	.02 to .15
Field border	.42 to.94

NRCS Conservation Practice Method	*Atmospheric/soil Benefit (mg Carbon captured per hectare) 1Mg= 1 megagram or 1 metric ton*
Filter strips	.42 to .95
Grassed waterways	.42 to .96
Strip-cropping	.02 to .17
Vegetative barriers	.42 to .94
Herbaceous wind barriers	.42 to .95

The Carbon Cycle



Anthropogenic activities such as the burning of fossil fuels have released carbon from its long-term geologic storage as coal, petroleum, and natural gas and have delivered it to the atmosphere as carbon dioxide gas. The amount of carbon dioxide in the atmosphere has increased since the beginning of the industrial age, and this increase has been caused mainly by the burning of fossil fuels. Carbon dioxide is a very effective greenhouse gas—that is, a gas that absorbs infrared radiation emitted from Earth's surface. As carbon dioxide concentrations rise in the atmosphere, more infrared radiation is retained, and the average temperature of Earth's lower atmosphere rises. This process is referred to as global warming.

Reservoirs that retain carbon and keep it from entering Earth's atmosphere are known as carbon sinks. Carbon is transferred naturally from the atmosphere to terrestrial carbon sinks through photosynthesis; it may be stored in aboveground biomass as well as in soils. Beyond the natural growth of plants, other terrestrial processes that sequester carbon include growth of replacement vegetation on cleared land, land-management practices that absorb carbon.

[1] Ryals, R. et al. (2013) "Effects of Organic Matter Amendments on Net Primary Productivity and Greenhouse Gas Emissions in Annual Grasslands," Ecological Applications 23, no. 1 (2013): 46–59. Ecosystem Science Division, Department of Environment Science, Policy, and Management, University of California at Berkeley.
[2] California Air Resources Board (2019). CA 2030 NWL Climate Change Implementation Plan. https://ww3.arb.ca.gov/cc/natandworkinglands/draft-nwl-ip-040419.pdf?_ga=2.184737389.539979434.1587673510-873784356.1575493161.
[3] Lal, R. (2016). Soil carbon sequestration potential of Us croplands and grasslands (Vol. 71). Journal of Soil and Water Conservation. https://www.c-agg.org/wp-content/uploads/Chambers_Paustian_Lal_Soil_Carbon_and_4_per_1000-1.pdf